

Final Report

SIMULATION STUDIES FOR NOAA STABILIZED COMPENSATION PROGRAM

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by

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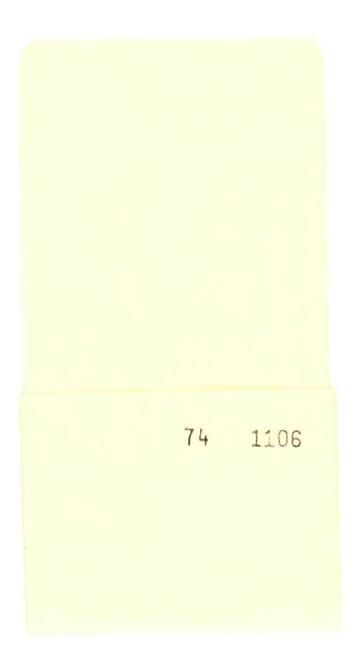
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FOREWORD

This report was prepared by the Research Triangle Institute, Research Triangle Park, North Carolina, under Contract 2-35369. The work has been administered by the Data Processing and Analysis Division, National Environmental Satellite Service, National Oceanic and Atmospheric Administration. Dr. John A. Leese is the NESS Technical Representative for the contract.

1973

The program studies began on 21 April, 1972, and were completed on 20 May 1973. Participating RTI staff members were as follows:

- W. H. Ruedger, Project Leader
- G. S. Brown, Member of the Technical Staff
- J. H. White, Member of the Technical Staff



ABSTRACT

This report describes the participation of the Research Triangle Institute in the NOAA/NESS program to achieve data quality assurance. Long-term observation of the quality of the data from the scanning radiometer systems aboard the ITOS type spacecraft has indicated that a requirement exists for a systematic means of maintaining data quality. Previous studies have further indicated that the alignment of the equipment used to compensate for spacecraft tape recorder flutter effects was particularly sensitive in affecting data quality. This equipment was selected as the subject of a pilot program to assure data quality by stabilized control. RTI has contributed to the overall objective of this pilot program by conducting analyses of the z-axis* compensation technique as it interacts with the data and by recommending diagnostic logic to survey data quality as the data areingested from the Command and Data Acquisition Station (CDA).

*NOAA nomenclature referring to the flutter components introduced at the spacecraft tape recorder.

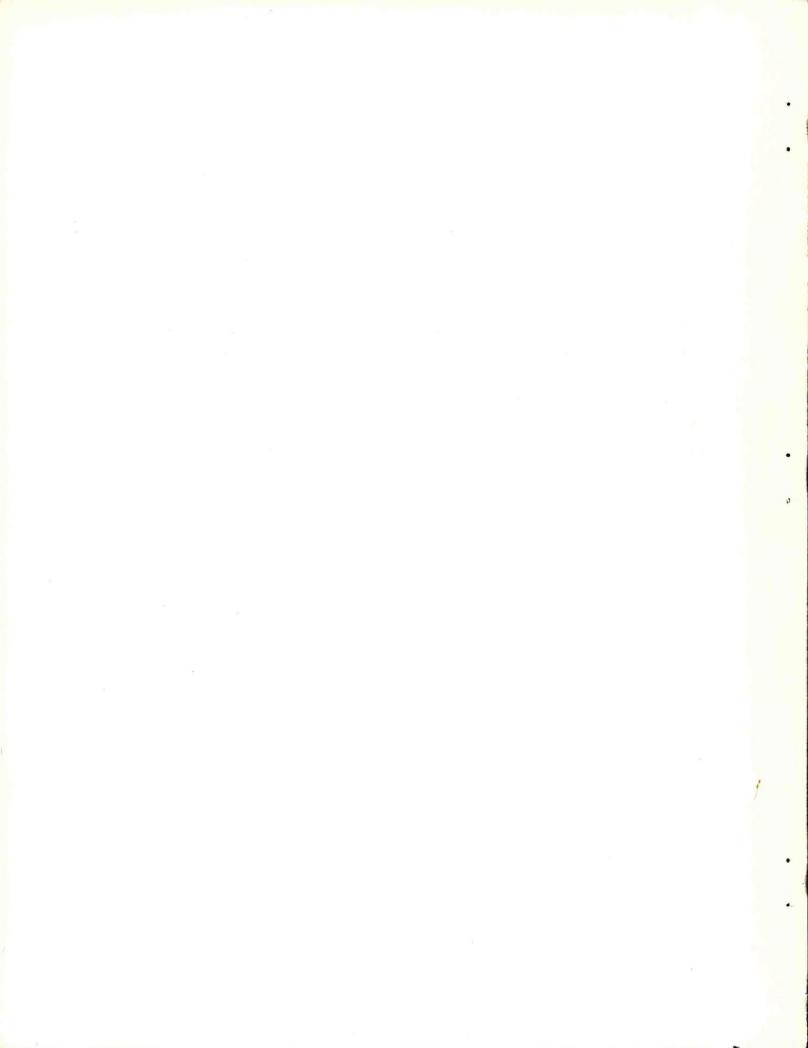


TABLE OF CONTENTS

		Page No.
	FOREWORD	iii
	ABSTRACT	v
1.0	INTRODUCTION	1
2.0	FM MODULATION CONSIDERATIONS	5
	2.1 Theory2.2 Spectral Considerations	5 6
3.0	Z-AXIS RACK OPERATION	13
	3.1 Discriminator Operation3.2 Flutter Compensation Technique	13 17
4.0	MODEL DESCRIPTION	21
	4.1 Reference Channel4.2 Data Channel4.3 Analysis Technique	21 24 25
5.0	SENSITIVITIES DERIVED FROM MODEL	27
6.0	PRELIMINARY RECOMMENDATIONS FOR DIAGNOSTIC IMPLEMENTATION	39
7.0	RECOMMENDED STANDARD OPERATING PROCEDURES	43
8.0	RECOMMENDATIONS FOR FUTURE EFFORT	45
9.0	APPENDICES	47
	 A. Model Implementation (Block Diagram) B. Input Description/Output Options C. Standard Output Format D. Sample Listing E. Detailed Standard Operating Procedure 	49 51 59 63 109
10.0	REFERENCES	119

ILLUSTRATIONS

Figure		Page No.
1-1	ITOS Scanning Radiometer Data Flow.	2
1-2	Overall Data Quality Assurance Philosophy.	3
2-1	An FM Line Spectrum, Single Tone Modulation.	8
2-2	Bessel Functions of Fixed Order Plotted Versus the Argument $\boldsymbol{\beta}$.	8
2-3	Tone-Modulated FM Line Spectra Showing the Effects of Tone Amplitude and Frequency.	9
2-4	Spectra Showing the Failure of Superposition in Frequency Modulation.	10
3-1	Basic Discriminator Block Diagram.	13
3-2	Basic Discriminator Operation - Waveforms.	14
3-3	Constraints on Detector Pulse Width.	15
3-4	Z-Axis Rack Compensation Technique.	16
3-5	Compensation of Flutter Only Condition.	18
4-1	Overall Block Diagram of Model Implementation.	22
5-1	Flutter Residual versus Main Delay Error in $\mu \texttt{s}$.	28
5-2	Flutter Residual versus (Model) Ref. Disc. Output Gain.	30
5-3	Data Channel Output Spectra for First Three Cases Shown in Table 5-4.	36
5-4	Effect of Changing Filter Roll-Off.	37
6-1	Preliminary Diagnostic Logic Flow Diagram.	40
6-2	Initial Diagnostic Configuration.	42
A-1	Block Diagram of Model Implementation.	50
C-1	Sample Model Output Format.	60
E-1	Initial Set-up for Delay Adjustment.	111
E-2	Daily Check for Delay Adjustment.	113
E-3	F&W Discriminator Zero Balance Test Set-Up.	114

Figure		Page No.	
E-4	Data Discriminator and VCO Balance Test Set-Up.	115	
E-5	Master Tape Recording Set-Up.	118	

TABLES

Page No.

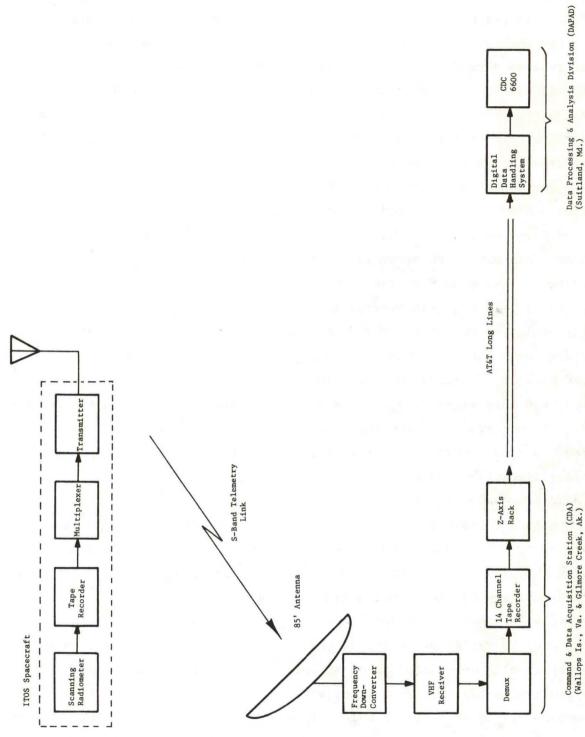
4-1	Parameter Options	23
5-1	Tones on Data and Flutter Channels - Delay Error Effect ITOS-D Configured at 4:1	31
5-2	Tones on Data and Flutter Channels - Gain Adjustment Effect	32
5-3	Noise on Flutter Channel - White, Uniform Dist., $\sigma^2 = 0.11$	34
5-4	Noise and Four Tones on Flutter Channel, Four Tones	34

1.0 INTRODUCTION

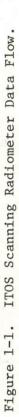
This report describes the participation of the Research Triangle Institute in the NOAA/NESS program to achieve data quality assurance. Long-term observation of the quality of the data from the scanning radiometer systems aboard the ITOS type spacecraft has indicated that a requirement exists for a systematic means of maintaining data quality. Previous studies have further indicated that the alignment of the equipment used to compensate for spacecraft tape recorder flutter effects was particularly sensitive in affecting data quality. This equipment was selected as the subject of a pilot program to assure data quality by stabilized control. RTI has contributed to the overall objective of this pilot program by conducting analyses of the z-axis compensation technique as it interacts with the data and by recommending diagnostic logic to survey data quality as the data are ingested from the Command and Data Acquisition Station.

Figure 1-1 shows the overall flow of ITOS scanning radiometer data. During real time operation, the data are recorded on the spacecraft tape recorder for subsequent readout. During acquisition the tape recorder is played back at an increased speed, the data is frequency division multiplexed, and then transmitted to the ground station via an S-Band telemetry link. At the ground station the data is received, demultiplexed and recorded. During recorder playback, the data is z-axis corrected and fed to the long lines for transmittal to DAPAD where it is digitized and input to the data processing equipment.

Figure 1-2 indicates the overall philosophy of the program to stabilize data quality. The concept consists of monitoring specific parameters in the data as they are ingested into the Digital Data Handling System (DDHS), conducting analyses in real-time, evaluating these analyses and communicating informative diagnostics to the CDA if data quality is not being maintained. In the event a fault does exist at the CDA, it is anticipated that these diagnostics will be of assistance in localizing and correcting this condition. This program represents an on-going effort at NESS. As a result, this report documents only those areas in which RTI was directly involved. This involvement consisted of an investigation of the compensation technique, the development of a digital model of the hardware, and the use of this model to derive sensitivities to be used as guidelines in the development of the required diagnostic logic.







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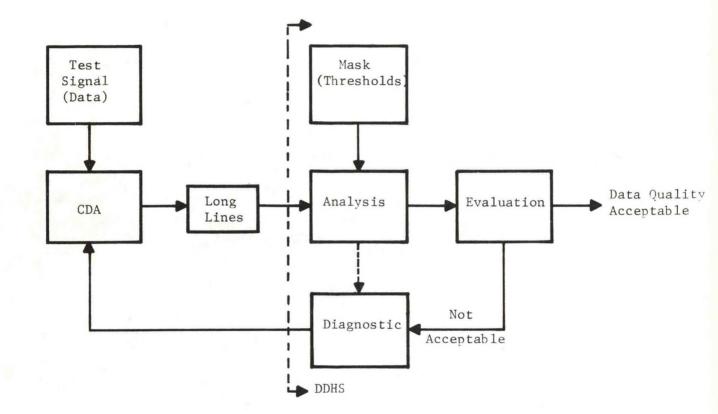
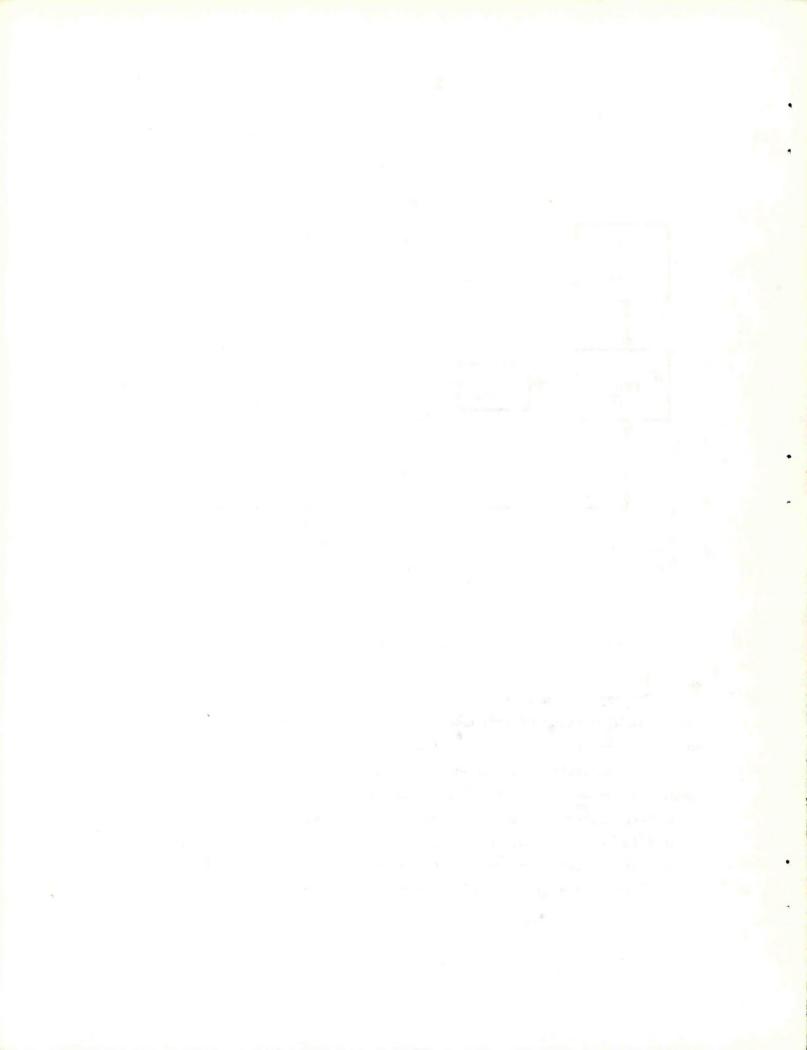


Figure 1-2. Overall Data Quality Assurance Philosophy.

The report has three main features. The initial sections present a tutorial discussion of frequency modulation theory to serve as background and also a tutorial discussion of the theory of operation of the z-axis compensation technique. Subsequent sections describe the model, pertinent analyses conducted with the model, and preliminary diagnostic logic recommendations based on these analyses. The computer algorithm is then documented in detail in the appendices. It is hoped that this approach will result in the report being a working document for NESS and RTI personnel as well as documenting the effort expended during the study.



2.0 FREQUENCY MODULATION CONSIDERATIONS

This section presents a tutorial introduction to the mathematical aspects of frequency modulation. The intent here is to indicate the effects of the modulation technique being non-linear. Of prime concern is the spectral representation of an FM modulated waveform, especially the facts that spectral superposition does not apply and that tone modulation has a distributed spectral representation which is tone amplitude dependent.

2.1 Theoretical Considerations

The "frequency" of a waveform is defined as the time-rate-of-change of phase and as such usually suggests a periodic phenomenon (i.e. in the spectral sense). On the other hand "frequency modulation" implies a time varying frequency which is contrary to the usual notion. It therefore becomes important in the context of frequency modulation to distinguish between "spectral" and "instantaneous" frequencies.

In general, a frequency modulated wave x (t) can be written as

$$\mathbf{x}_{c}(t) = \mathbf{A}_{c} \cos \Theta_{c}(t) \tag{2-1}$$

where A_c is constant and $\Theta_c(t)$ is a function of the carrier frequency and some baseband signal x(t). In order to distinguish between the two types of frequency mentioned in the preceding paragraph, $\Theta_c(t)$ can be written as

$$\Theta_{c}(t) = 2\pi f_{c}t + \phi(t)$$

where f_c is the carrier (spectral) frequency and $\phi(t)$ contains the baseband signal x(t). Returning to the concept that frequency is the time-rate-of-change of phase, one can define "instantaneous" frequency as

$$\xi(t) = \frac{1}{2\pi} \frac{d}{dt} \Theta_{c}(t) = f_{c} + \frac{1}{2\pi} \frac{d\phi(t)}{dt}$$

If the baseband signal is now taken to be the change in instantaneous frequency as a function of time,

$$\xi(t) = f_c + f_D x(t)$$

(where ${\bf f}_{\rm D}$ is called the "deviation" constant and is a system parameter), one can identify

$$\frac{d\phi(t)}{dt} = 2\pi f_{\rm D} x(t)$$

or

$$\phi(t) = 2\pi f_{D} \int_{0}^{t} x(\tau) d\tau .$$

Now the modulated wave given in eq. 2-1 can be written as

$$x_{c}(t) = A_{c} \cos[\omega_{c}t + 2\pi f_{D} \int_{0}^{t} x(\tau) d\tau] \qquad (2-2)$$

indicating the relation between a baseband signal and the modulated carrier.

The point of this discussion is to demonstrate that an intuitive notion of the relationship of the spectral distribution of signal information at baseband and its distribution after modulation is not available. This will be pursued in greater detail in the following section which deals with the spectrum of a frequency modulated wave.

2.2 Spectral Analysis of Modulated Carrier

The spectral analysis of a frequency modulated carrier is pertinent to the study in that data processing equipment bandwidths are continually of interest. For this reason a discussion of the behavior of the spectral distribution of the modulated carrier is included. The approach will be to initially examine the behavior of a carrier modulated by a single tone as a function of tone amplitude and frequency and to then extend this to a two tone situation. Multiple tone situations will not be discussed as they are simply mathematically complicated extensions of the two tone case and offer no additional insight.

Consider the baseband tone,

 $x(t) = A_{m} \cos \omega_{m} t$

Equation 2-2, the modulated carrier takes on the form,

$$x_{c}(t) = A_{c}\cos(\omega_{c}t + 2\pi f_{D} \int_{0}^{t} A_{m}\cos(\omega_{m}\tau d\tau)$$
$$= A_{c}\cos(\omega_{c}t + \frac{f_{D}A_{m}}{f_{m}}\sin(\omega_{m}t) .$$

Define,

$$\beta = \frac{f_D^A m}{f_m}$$

and obtain

$$x_{c}(t) = A_{c}\cos(\omega_{c}t + \beta \sin\omega_{m}t) \qquad (2-3)$$

The parameter β is termed the <u>modulation</u> index and represents the maximum phase deviation produced by the tone. Rewriting equation 2-3 as

$$x_{c}(t) = A_{c}[\cos\omega_{c}t \cos(\beta \sin\omega_{m}t) - \sin\omega_{c}t \sin(\beta \sin\omega_{m}t)]$$

and writing $\cos(\beta \sin \omega_m t)$ and $\sin(\beta \sin \omega_m t)$ in terms of Bessel functions of the first kind, one can achieve a Fourier series type representation for $x_c(t)$. In particular,

$$\begin{aligned} \mathbf{x}_{c}(t) &= \mathbf{A}_{c} \mathbf{J}_{o}(\beta) \ \cos \omega_{c} t \\ &+ \sum_{n \text{ odd}}^{\infty} \mathbf{A}_{c} \mathbf{J}_{n}(\beta) [\cos(\omega_{c} + n\omega_{m})t - \cos(\omega_{c} - n\omega_{m})t] \\ &+ \sum_{n \text{ even}}^{\infty} \mathbf{A}_{c} \mathbf{J}_{n}(\beta) [\cos(\omega_{c} + n\omega_{m})t + \cos(\omega_{c} - n\omega_{m})t] \end{aligned}$$

Notice that the spectrum of the modulated carrier consists of an <u>infinite</u> number of lines spaced at intervals of ω_m about the carrier with amplitudes that vary as Bessel functions of the modulation index. An illustrative line

spectrum for a frequency modulated tone is shown as Figure 2-1.

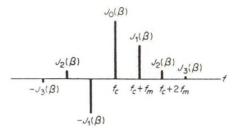


Figure 2-1. An FM line spectrum, single tone modulation.

Further, notice that for a given tone frequency, the modulation index β changes as the <u>amplitude</u> of the tone varies which produces a different spectral distribution. Figure 2-2 shows the behavior of Bessel functions versus their argument.

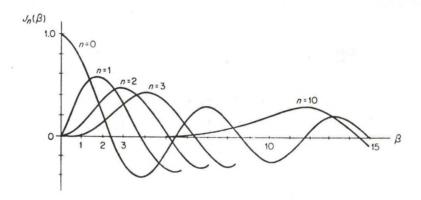


Figure 2-2. Bessel functions of fixed order plotted versus the argument β .

One may view the variation in spectral distribution as a function of amplitude and frequency by noting that the harmonics generated by $\beta=2$ are quite different from harmonics generated by $\beta=4$. This differential in β could be simply the result of a two-to-one increase in tone amplitude. Notice that for $\beta=12$ (which incidentially represents an unlikely situation), the maximum spectral line occurs at n=10 which represents a frequency ten times the tone frequency and would require an extremely wide channel bandwidth. Figure 2-3

indicates the effect of changing tone amplitude and frequency. The effect of amplitude only and frequency only changes are indicated (recall that $\beta ~ \sim \frac{A}{f} ~) \,.$

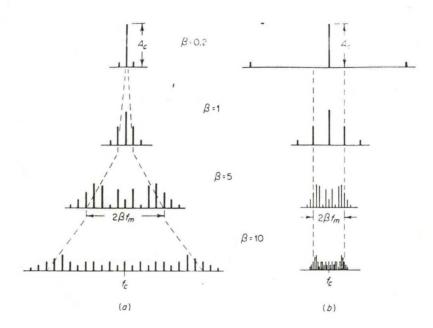


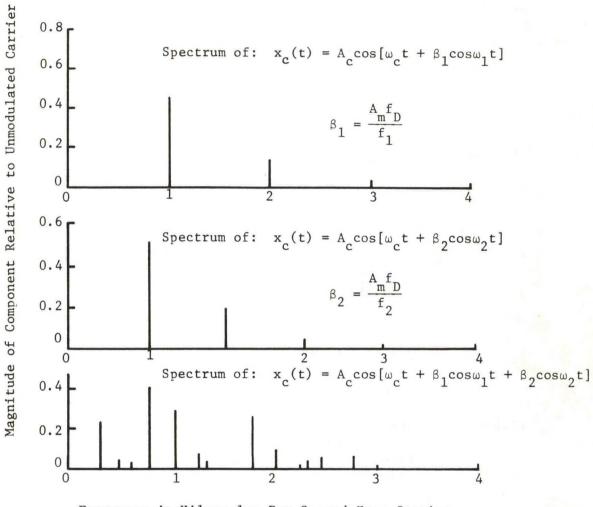
Figure 2-3. Tone-modulated FM line spectra showing the effects of tone amplitude and frequency. (a) frequency fixed, increasing amplitude; (b) amplitude fixed, decreasing frequency.

The preceding discussion has treated the behavior of the spectrum for only a single tone. It is of interest to consider the additional influence of a multiple tone signal as this represents a more realistic situation. The mathematics of investigating the general multitone situation is extremely cumbersome and, as a result, only the two tone case will be discussed here. This is adequate as all the pertinent effects will be revealed.

Following the mathematical procedure introduced for a single tone and omitting the intermediate details, for a signal of the form

 $x(t) = A_1 \cos \omega_1 t + A_2 \cos \omega_2 t$

where f_1 and f_2 are not harmonically related, one can write the modulated carrier as,



Frequency in Kilocycles Per Second From Carrier

Figure 2-4. Spectra Showing the Failure of Superposition in Frequency Modulation.

$$x_{c}(t) = A_{c} \sum_{n}^{\infty} \sum_{m}^{\infty} J_{n}(\beta_{1}) J_{m}(\beta_{2}) \cos(\omega_{c} + n\omega_{1} + m\omega_{2})t .$$

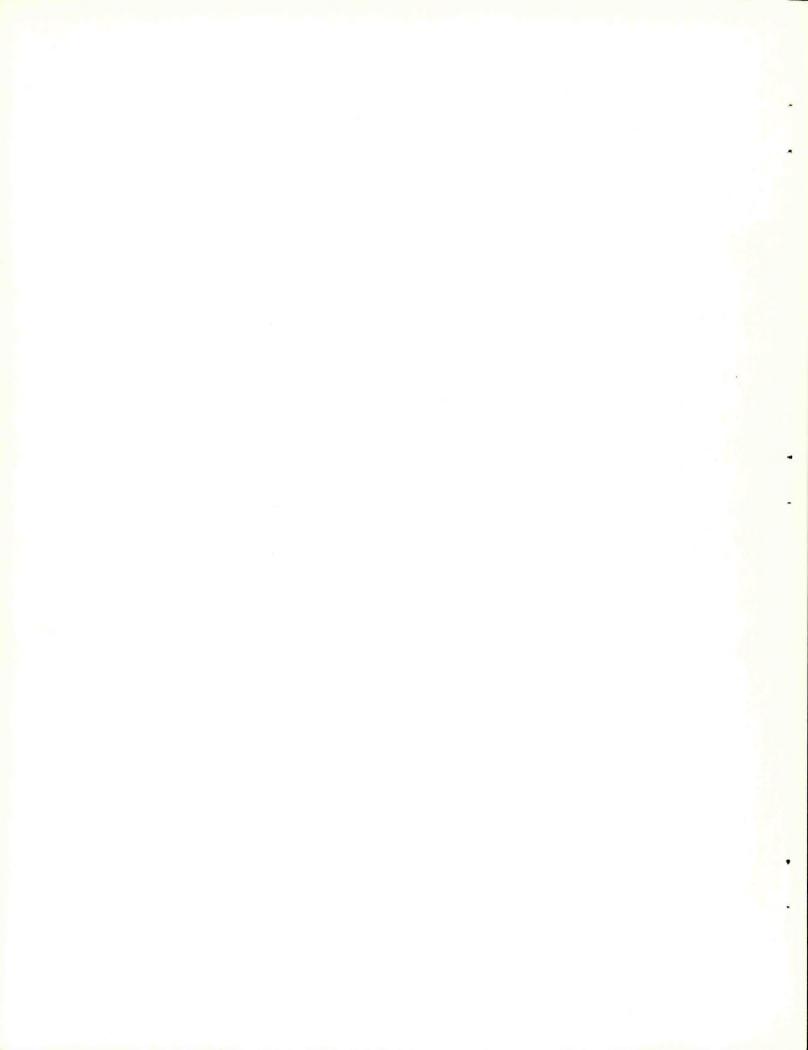
Again, without including the details, this may be interpreted in the spectral domain as being divided into four categories:

1. the carrier alone at f

- 2. sidebands at $f_{c} + nf_{1}$ due to f_{1} alone
- 3. sidebands at $f_{c} + mf_{2}$ due to f_{2} alone
- and 4. sidebands at $f_c + nf_1 + mf_2$ due to the beat-frequency modulation between the two tones.

This last category is the result of the modulation process being non-linear and, as would be expected, gives rise to the feature of FM that spectral superposition does not hold and as such data interaction can occur if the modulated carrier is bandlimited to any extent. Figure 2-4 demonstrates this effect by presenting the single and sum spectra of two tones.

The preceding discussion has been brief, but has demonstrated the data dependence of the modulated subcarrier spectrum. The basic reason for including this discussion is to admit that bandpass filtering the modulated carrier may cause distortion of the baseband signal and interaction of spectral harmonics. Standard rules of thumb are common in selecting bandwidth requirements and are conditioned on the data characteristics. For example "Carson's Rule" provides that for most applications, a bandwidth of \pm (f_D + f_m) about the carrier frequency is adequate (f_D is the previously mentioned deviation constant and f_m is the highest frequency in the baseband signal). These topics are explored in greater detail in references 2-1 and 2-2.



3.0 Z-AXIS RACK OPERATION

This section presents a qualitative discussion of the operation of the z-axis rack. Included is an introduction to pulse-averaging discriminator operation and utilization of the output of the reference discriminator in order to compensate for tape recorder speed error.

3.1 Discriminator Operation

A block diagram of the basic pulse-averaging discriminator (see ref. 3-1) used in the z-axis rack is shown in Figure 3-1. The input bandpass filter shown is not necessary for the discussion but is included for completeness.

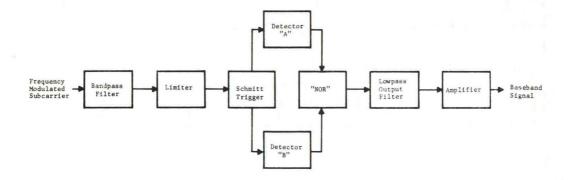


Figure 3-1. Basic Discriminator Block Diagram.

Figure 3-2 indicates waveforms encountered at various locations in the discriminator and may be used to describe the functional operation of this type of FM demodulator. Figure 3-2-a indicates a simple 290 Hz base-band tone which will be used to modulate a 5000 Hz sub-carrier. (It should be noted that the waveform parameters such as subcarrier frequency, etc., were chosen for ease of graphic presentation rather than as representative of the actual hardware configuration.) A portion of the modulated subcarrier is shown in Figure 3-2-b. This represents the input to the discriminator.

This frequency modulated subcarrier is first "hard limited" at the input in order to remove any residual amplitude modulation that may have been introduced in the satellite modulator, multiplexer and transmitter or in the ground station receiver and demultiplexer. The resultant waveform is shown in Figure 3-2-c. It should be remarked that limiting does not theoretically introduce base-band distortion in that all base-band information

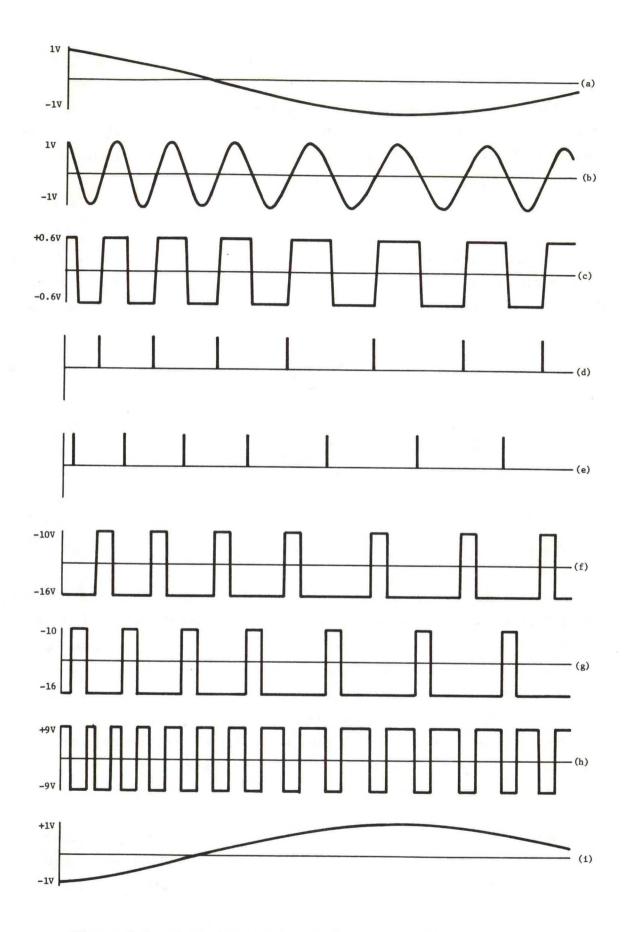
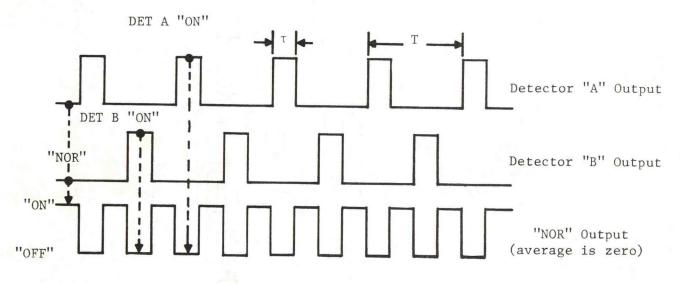


Figure 3-2. Basic Discriminator Operation - Waveforms.

is contained in the zero-crossings of the frequency modulated subcarrier. These crossings are accurately preserved in the process of limiting.

The limited subcarrier is then fed to a Schmitt Trigger for purposes of detecting the aforementioned zero crossings. The Schmitt Trigger outputs a pulse each time the limited waveform passes through zero. A separate pulse is output depending on whether the zero crossing was positive going or negative going. The upcrossings are indicated in Figure 3-2-d and the downcrossings in Figure 3-2-e. The upcrossings are fed to detector "A" and the downcrossings to detector "B" where the pulses are "stretched" to have a width which is one-fourth the period of the unmodulated subcarrier. This choice of pulse width is not arbitrary. It results from the constraints that an unmodulated subcarrier will provide zero at the output of the demodulator and that one of the effects of the "NOR" is to act as a frequency doubler. Figure 3-3 indicates the relationship between the subcarrier period and pulse width in the unmodulated situation. (This figure will be more informative if referred to again following the discussion of the "NOR" circuit and low pass output filter.)



T is period of the subcarrier

 τ is the detector pulse width (= T/4)

Figure 3-3. Constraints on Detector Pulse Width.

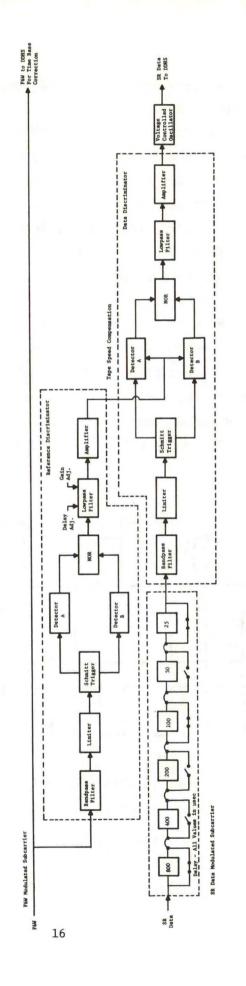


Figure 3-4. Z-Axis Rack Compensation Technique.

The outputs of detectors "A" and "B" are shown in Figures 3-2-f and 3-2-g, respectively.

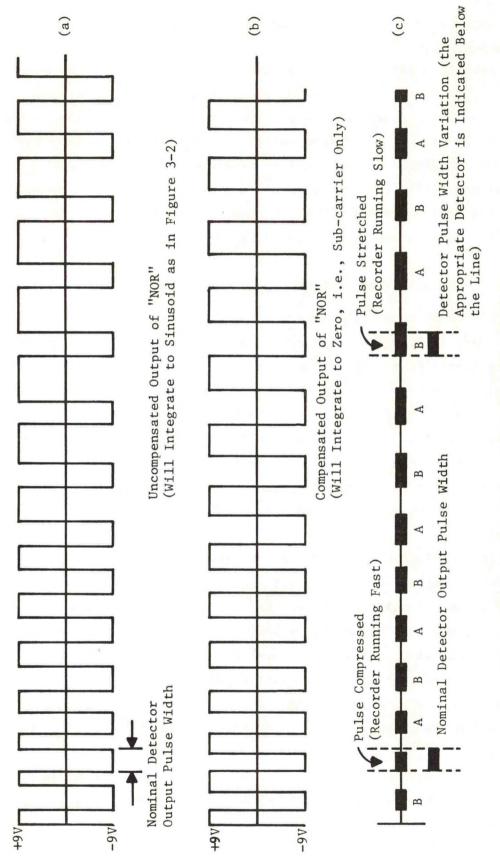
The stretched pulses are fed to the "NOR" circuit. This circuit produces an "ON" condition if there is a pulse from neither detector "A" nor detector "B" as shown in Figure 3-2-h. Notice that the time the waveform spends in the "ON" condition varies with time while the time spent in the "OFF" condition does not. This waveform when low-pass filtered (i.e. averaged) will produce the waveform shown in Figure 3-2-i. Notice that the original base-band signal is recovered exactly except for a change in polarity. The polarity is reversed in the output amplifier.

3.2 Flutter Compensation Technique

The effect of tape speed error on the spacecraft tape recorder is to shift the data sub-carrier frequency to a higher frequency when the recorder is running faster than nominal and to a lower frequency when the tape recorder is running slower than nominal. Since flutter is a time varying error in recorder speed, its effect is to deviate the carrier from nominal in some time varying fashion. This is equivalent to frequency modulating the subcarrier with the flutter variations. By recording an unmodulated sub-carrier on a separate track on the tape recorder, a flutter only signal may be recovered upon playback for use in correcting the flutter corrupted data subcarrier.

A detailed block diagram of the correction scheme is shown in Figure 3-4. Further design details may be found in ref. 3, but have been omitted here as they do not substantially contribute to the theory of operation of the compensation technique. The basic theory behind the technique is to translate the flutter only signal to baseband (demodulate the subcarrier) by means of a "reference" discriminator. This signal is then used to vary the pulse width in the data discriminator detectors. When the "NOR" output is subsequently integrated (in the low-pass output filter), the result is as if no flutter had been present.

Figure 3-5 indicates the "NOR" output waveforms for the uncompensated and compensated situations. Figure 3-5-a shows the uncompensated case as was also seen in Figure 3-2. Notice that in the "OFF" state (-9v), the duration per cycle is constant due to a pulse being present with nominal width.





In Figure 3-5-b is shown the output of the "NOR" after the detector pulse widths have been modified. For the case where the recorder is running faster than nominal, the pulse width is compressed while when the recorder is running slower than nominal, the pulse width is expanded. Note that although the <u>frequency</u> of the resultant waveform varies as a function of the flutter, <u>the</u> <u>output of the low-pass filter</u> (an integrator) will be zero indicating that <u>the flutter effect has been removed</u>. It should be emphasized that the present discussion is concerned with a flutter only situation. In the presence of joint flutter and data information, only the flutter components are (theoretically) affected; the data are preserved intact.

At this point it is logical to discuss the prominent features of rack alignment as they relate to overall performance. The salient features of interest here are, 1) the scaling between the reference discriminator output and the extent of detector pulse width modification, and 2) the phase (or time) synchronization between the reference discriminator output and the detector outputs in the data discriminator.

With regard to the reference discriminator output scaling, consider the compensated data channel detector output pulse width to be represented by

T_{nominal} + K·V_{flutter}(t)

where T_{nominal} is (as has been previously discussed) constrained to be onefourth the sub-carrier period and V_{flutter}(t) is the output voltage of the low-pass filter in the reference channel. The parameter "K" is then the scaling required to match this voltage to the correct percentage expansion and compression of the detector output pulses in the data channel to effectively remove the flutter. If "K" is zero, no compensation has taken place. On the other hand if "K" is less than the correct value, insufficient compensation will occur. Further, if "K" is greater than the correct value, the data channel will be overcompensated and the flutter components enhanced. This behavior can be viewed as linear up to a saturation point where the stretched pulses begin to overlap or the compressed pulses begin to vanish. (This saturation effect was not considered during the study as this situation is considered non-normal.)

Temporal synchronization is required as a result of two features in the ITOS SR data processing channel. First, the flutter and data signals are

modulated on different subcarrier frequencies in the multiplex scheme and thus have different transport times through the MUX/DEMUX electronics. Second, the flutter baseband signal is obtained after the low-pass filter and amplifier in the reference channel discriminator and used to modify the data channel discriminator at the detector circuits. Thus the transport delay(s) of the "NOR", low-pass filter, and output amplifier of the reference discriminator must be incorporated. The majority of the synchronization is achieved by delaying the data channel prior to demodulation. A secondary adjustment is available in the reference discriminator. However, it appears to be a phase adjustment only and thus does not possess the range of the main delay. In order to effect proper cancellation, the time delay is adjusted to synchronize the reference channel and the data channel. In the event that the two channels become phased 180° with respect to each other, a flutter enhancement occurs instead of cancellation. The extent of misalignment to cause enhancement is not considered likely at the ITOS identified flutter frequencies but could be significant if higher flutter frequencies were encountered.

4.0 MODEL DESCRIPTION

The basic approach to the model is that of a time domain simulation rather than development of a numerical treatment of theoretical transfer functions. This is largely the result of the non-linear functions encountered in the limiter, Schmitt Trigger, detectors, and the "NOR" circuits. The only exceptions to this design philosophy are the input band-pass filters and the lowpass output filters, where the frequency domain transfer functions were analytically specified and Fourier-transform, multiplication, inverse transform techniques were employed to avoid time-consuming numerical convolutions. Figure 4-1 shows an overall block diagram of the model implementation. The various approaches to each of the functional blocks are described in the following paragraphs. Table 4-1 indicates the parameter options incorporated into the model.

4.1 Reference Channel

The reference channel subcarrier frequency (f_0) is set at 6.25 Hz in order to be compatible with ITOS-D at 4:1 playback. The deviation index was selected to be \pm 15% about this. The input band-pass filter was modeled about these parameters. Initially a theoretical complex frequency plane description for the filter transfer function was attempted but was rejected due to design complexity, and an ideal (rectangular amplitude and linear phase response) filter substituted. This has the effect of producing better transmission characteristics within the band-pass but introduces possible distortion as the base-band information contained in the higher order sidebands of the modulated subcarrier is rejected. This is considered to be negligible for the tone modulation used in the analysis.

The input amplifier, limiter, and cascade amplifier parameters were selected to be compatible with the EMR discriminator described in ref. 3-1.

The Schmitt Trigger (zero crossing detector) was forced to trigger on a threshold of + 1 mv for upcrossings and -1 mv for downcrossings to account for quantization noise contained in the (model) digitized frequency modulated subcarrier. A distinct deviation from the EMR discriminator design was the substitution of +9 volt level for an "on" condition and a -9 volt level for an "off" condition in the pulse stretching detectors (normal levels are -10 volts for "on" and -16 volts for "off"). This deviation resulted from a requirement to change pulse <u>height</u> instead of width in the compensation scheme in order to achieve

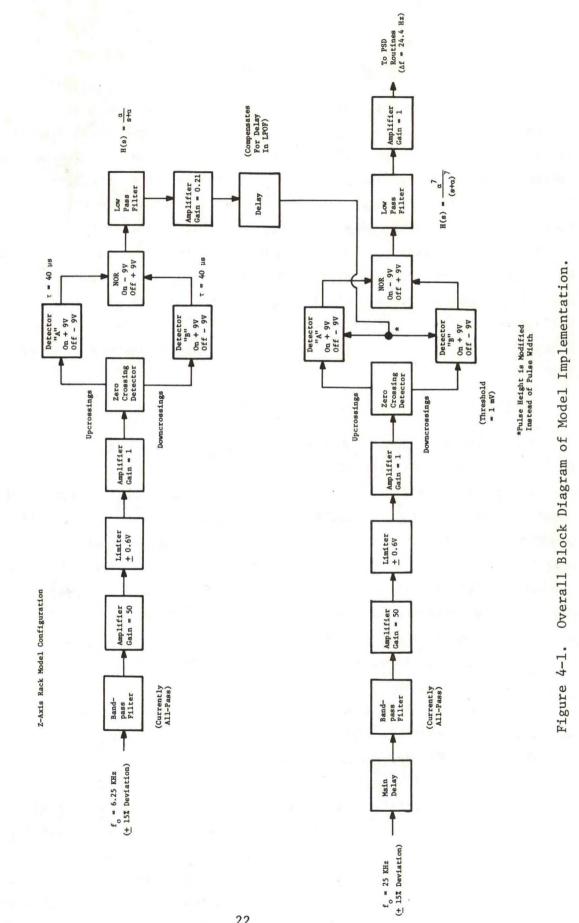


TABLE 4-1. PARAMETER OPTIONS

- 1. Transfer function of band-pass filter(s)
- 2. Input gain of limiter(s)
- 3. Clipping level
- 4. Output gain of limiter(s)
- 5. Inherent delay of limiter
- 6. Threshold of Schmitt Trigger(s)
- 7. Inherent delay of Schmitt Trigger
- 8. Pulse width scaling of detector (data only)
- 9. Pulse width of detectors
- 10. Output amplitude of detectors for "ON" condition ("ON" is pulse)
- 11. Output amplitude of detectors for "OFF" condition ("OFF" is no pulse)
- 12. Inherent delay of detectors
- 13. Output amplitude of "NOR" for "ON" condition
- 14. Output amplitude of "NOR" for "OFF" condition
- 15. Inherent delay of "NOR"
- 16. Transition voltage of "NOR"
- 17. Transfer function of low-pass filter(s)
- 18. Gain of output amplifier(s)
- 19. Main delay (error)

finer resolution (i.e., each pulse width represents a small finite number of words in the algorithm, thus a small amount of width compensation would be absorbed in time base quantization effects). The "NOR" circuit was modeled as a logical equivalent of the EMR circuitry with the specified levels of \pm 9 volts. Notice that the utilization of a "NOR" has the effect of doubling the subcarrier frequency and phase inverting the output signal (see section 3.0).

The output low-pass filter was modeled in the complex frequency domain and transform-inverse transform techniques employed. The filter has a 6 db/ octave roll-off and serves to integrate the output of the "NOR" circuit and to attenuate the contribution of the doubled subcarrier frequency.

The gain of the output amplifier was determined empirically for a single tone (see Section 5.0) and the polarity chosen to compensate for the phase inversion of the "NOR" circuit. Insofar as the amplifier is linear over its operating region the use of a single tone to determine the gain is justified.

An additional "delay" was incorporated into the model at the output of the reference discriminator to <u>advance</u> the reference signal with respect to the data subcarrier due to the delays encountered in the reference channel input bandpass filter and lowpass output filter. This would normally be achieved in the main delay in the data channel; however, in order to preserve the latter delay as a main delay "error", it was introduced at this point in the model.

4.2 Data Channel

The data discriminator is modeled essentially in the same manner as the reference discriminator with the following exceptions. First, the data channel subcarrier was shifted to 25 KHz instead of 22 KHz utilized in the hardware. This was necessitated by the requirement that the detector output pulse width be one-fourth the period of the subcarrier frequency and the requirement that this time span occupy an integer number of words in the computer algorithm. Since the percentage deviation remained at \pm 15%, this does not reflect any significant restriction on the model capability. Second, since the base-band signals and subsequently modulated subcarriers are generated within the algorithm, they are initially in phase and the requirement for a main delay per se does not exist. The main delay actually incorporated into the model

represents a delay "error" and is more meaningful in terms of overall rack operation. Third, the low-pass output filter was modeled (again in the complex frequency domain) as a seven pole passive filter with a roll-off of 42 dB per octave. This closely approximates the 40 dB/octave EMR specification. Fourth, the gain of the output amplifier was taken to be unity for convenience. This does not represent any compromise on model performance insofar as the areas of interest are represented by <u>relative</u> rather than absolute results.

4.3 Analysis Technique

The technique used for analysis of the results obtained from the model consisted primarily of the examination of flutter residuals and the sporadic harmonic behavior due to modulation non-linearities in the spectral domain. A sample output is shown in Appendix C. Additional comments regarding the specific analyses conducted are contained in **t**he following section.

5.0 SENSITIVITIES DERIVED FROM MODEL

The model was exercised parametrically to determine sensitivity to significant parameters. While the capability exists to analyse each of the parameters listed in Table 4-1, this study concentrated on the main delay and reference discriminator output gain settings. The reasoning behind this choice is twofold: one, the other parameters are considered to provide second order effects and, two, these two parameters represent critical adjustments in the z-axis rack alignment. These two parameters were initially tested by observing the degree of cancellation of a single tone imposed on both the data and flutter channels. Subsequently, analyses were conducted with multiple tones and random noise backgrounds.

Figure 5-1 shows the flutter residual after cancellation of a 1.2 count* tone at 196 Hz as a function of delay error in micro-seconds. A change in delay of 12.5 µ sec would produce a change in flutter residual of approximately 0.02 counts at this frequency, representing a change slightly in excess of 1.5%. Since 25 µ sec is the resolution of the delay line, it would appear that the ability to achieve the proper delay is available (i.e., + 12.5 μ sec) providing the required total delay is within the range of the delay line (1575 µ sec). Notice that since what is being affected in the compensation is a cancellation effect, as the tone frequency increases, the apparent total phase change due to 12.5 μ sec error also increases. At 800 Hz (approximately the highest flutter frequency identified on ITOS-D), 12.5 μ sec would produce a phase change equivalent to 50 μ sec at 200 Hz. From Figure 5-1, one can roughly anticipate a flutter residual of 0.08 counts or about 6% of peak. Thus based on pure tone cancellation, the delay line adjustment resolution is adequate for z-axis operation. It will be seen later that the non-linearities associated with the modulation technique make the establishment of the proper delay setting difficult in an operational environment.

^{*}The term "count" represents the output of an eight-bit digitizer at DDHS which encodes the dynamic range of the sensor into a range of 256 levels. Strict details of this encoding are omitted here. It is sufficient to remark that low count values represent high temperatures while high count values represent low temperatures. Two counts are roughly equivalent to one degree Kelvin at the warm end and this scale factor is fairly linear over the temperature range of interest.

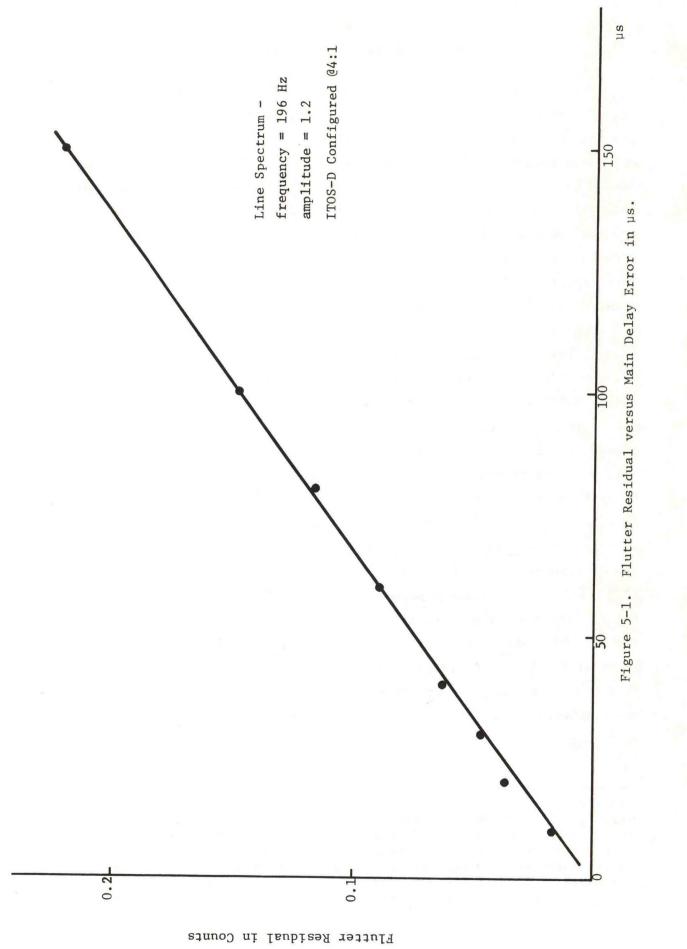


Figure 5-2 indicates the sensitivity of flutter residual as a function of reference discriminator output gain. Notice that zero gain represents no compensation and the original tone amplitude of 1.2 counts is preserved. In the range of zero to -0.21 the data channel is undercompensated while in the range of -0.21 to -0.6 overcompensation occurs. The gain is negative in sign to account for the inversion which occurs in the "NOR" circuit as described in Section 3.0. In the actual hardware this is achieved in the output amplifier while in the model it is achieved mathematically as the sign on the value input for the gain parameter. It should be noted that the absolute value of gain was derived empirically in order to effect <u>model</u> performance and may not reflect the actual <u>hardware</u> gain of the output amplifier. The value is indicative of relative behavior. No attempt was made to examine the saturation effect described in Section 3.0. As in the case of the delay setting, it will be shown later that an optimum gain setting will be difficult to achieve in an operational situation.

Table 5-1 shows the effect of modulating the data and flutter channels with four tones nominally identified to have the same frequency and amplitude as ITOS-D flutter components, and subsequently observing rack operation as the main delay is perturbed from its nominal setting. Notice the tone at 782 Hz deteriorates back to the no compensation condition more rapidly than lower frequencies. This is caused by a given delay representing a larger phase error at the higher frequencies. As a result, the no-compensation and flutter enhancement situations are reached sooner at the higher frequency tones. Notice that this behavior is similarly observed for tones at 102 Hz and 417 Hz. Note that a contrary effect is observed for the tone at 156 Hz where a delay error actually improves the rack performance until an error of 100 µs is reached. This is considered to be due to the fact that due to the significant difference in tone amplitude, the tone is spectrally distributed differently and that in effect the non-linearity of the modulation technique has produced a phenomenon wherein the rack would appear to be exceeding the theoretical single tone performance. It should be commented that this type of data interaction was found to be prevalent in all multiple tone analyses. It is this type of behavior which causes the actual hardware to be difficult to align operationally.

Table 5-2 indicates the effect of varying the reference discriminator gain on the rack performance with the four tones described in the previous paragraph. Notice that the phenomenon of data interdependence is much more

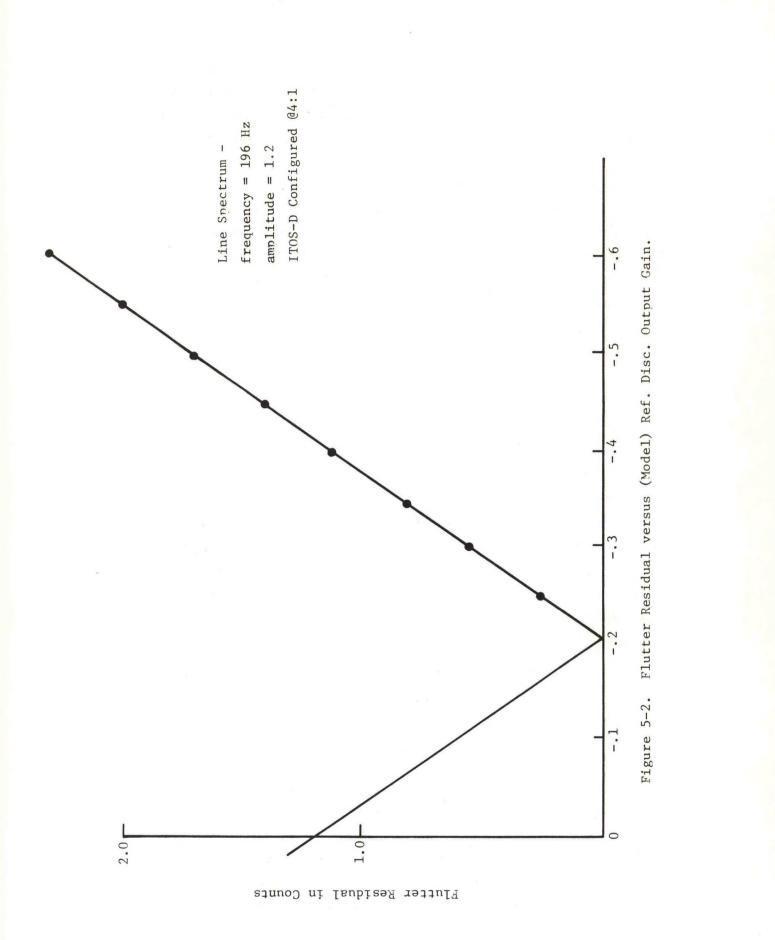




TABLE 5-1. TONES ON DATA AND FLUTTER CHANNELS - DELAY ERROR EFFECT ITOS-D CONFIGURED AT 4:1

Delay				
Error µs	<u>102 Hz</u>	156 Hz	417 Hz	782 Hz
No Compensation	0.439	0.109	0.763	0.370
0	0.020	0.011	0.017	0.081
10	0.021	0.018	0.028	0.086
20	0.022	0.018	0.041	0.087
30	0.024	0.009	0.055	0.082
40	0.026	0.007	0.075	0.089
60	0.031	0.004	0.115	0.110
80	0.036	0.002	0.153	0.135
100	0.041	0.001	0.192	0.162
150	0.052	0.009	0.290	0.234
200	0.070	0.007	0.388	0.308

Values for no-compensation represent flutter tone <u>amplitude</u> in counts. The other values represent flutter residual in counts.

TABLE 5-2. TONES ON DATA AND FLUTTER CHANNELS - GAIN ADJUSTMENT EFFECT

Gain*	102 Hz	156 Hz	417 Hz	782 Hz
No compensation	0.476	.112	.780	.379
-0.17	.070	.011	.191	.133
-0.18	.047	.010	.157	.119
-0.19	.024	.012	.122	.105
-0.20	.014	.017	.088	.091
-0.21	.030	.022	.053	.078
-0.22	.053	.028	.021	.065
-0.23	.076	.034	.020	.054
-0.24	.100	.040	.053	.044
-0.25	.124	.047	.087	.038
-0.26	.147	.053	.121	.037

Values for no compensation represent flutter tone amplitude in counts. The other values represent flutter residual in counts.

*The values of gain are model dependent and should be interpreted only in a relative sense.

radical here as evidenced by the (underlined) gain at which each tone is most effectively cancelled. In this case it is virtually impossible to define an optimum setting. Note that the various values tend to cluster around the -0.21 value obtained for the single tone at 196 Hz shown in Figure 5-2.

In view of the fact that the delay and gain adjustments are set simultaneously in an operational situation, the difficulty in identifying an optimum setting for delay and gain is further emphasized. In the model case, the situation is somewhat simplified in that the frequency modulated signals are initially in time synchronization. The only differential delay up to the point of compensation is due to the input band-pass filters of the reference and data discriminators. Since these have been modeled as ideal filters with linear phase response, the transit delay may be calculated exactly (the delay is given by the slope of the phase response). Thus in the model, lack of knowledge about the delay setting does not influence the gain setting analysis. However, in the hardware situation, the alignment resorts to an iterative process. It has been observed in actual testing that the main delay setting is the better initial parameter to adjust in achieving the final alignment.

Table 5-3 indicates an analysis where no tone modulation was applied to either the flutter or data sub-carriers and noise alone imposed on the flutter sub-carrier only. The intent here was to demonstrate the fact that noise on the flutter channel would result in increased noise level on the data channel output via the flutter compensation technique. The notation is defined as follows:

 $\sigma_{\rm NC}^2$ = the noise variance of the data channel output with no compensation $\sigma_{\rm C}^2$ = the noise variance of the data channel output with compensation

 σ_n^2 = the contribution of noise in the data channel output due to noise on the flutter channel.

The data channel output has an apparent noise output due to quantization effects in the digital model. The important parameter to view here is σ_n^2 as a function of the bandwidth of the low-pass output filter on the reference discriminator. As would be expected, as the bandwidth is reduced, the noise variance reduces nearly proportionately.

Bandwidth of low- pass output filter	σ ² _{NC}	σ ² _C	σ_n^2	
2 kHz	0.012	0.097	0.085	
1 kHz	0.012	0.053	0.041	
500 Hz	0.012	0.032	0.020	
250 Hz	0.012	0.021	0.009	
100 Hz	0.012	0.017	0.005	

Table 5-3. Noise on Flutter Channel - White, Uniform Dist., $\sigma^2 = 0.11$.

 $\sigma_n^2 = \sigma_{NC}^2 - \sigma_C^2$ (since the noise samples are uncorrelated).

Table 5-4.	Noise and I	Four Tones	on Flutter	Channel,	Four	Tones	on	Data
			nannel					

dB	Improvement

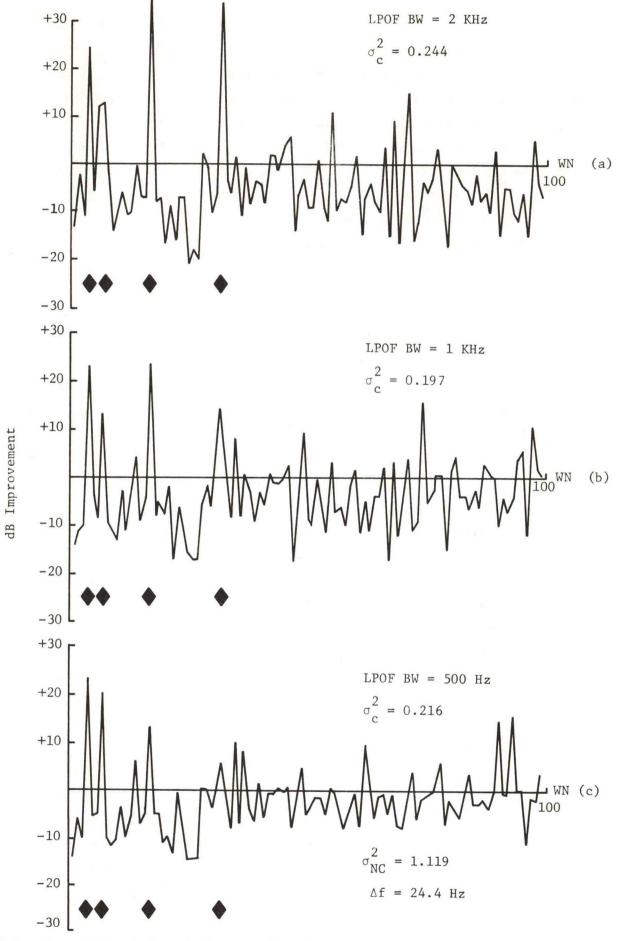
Bandwidth of low- pass output filter	102 Hz	156 Hz	417 Hz	782 Hz	σ ² C	
2 kHz	24.0	13.0	49.9	34.0	0.244	1
1 kHz	22.7	13.2	23.8	14.4	0.197	
500 Hz	23.5	20.1	13.4	6.2	0.216	
250 Hz	22.0	23.9	5.5	0.3	0.447	
100 Hz	12.6	5.8	-1.0	0.0	1.055	

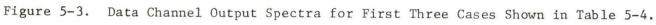
 $\sigma_{\rm NC}^2 = 1.119$

Values represent "dB Improvement" as defined in Appendix C.

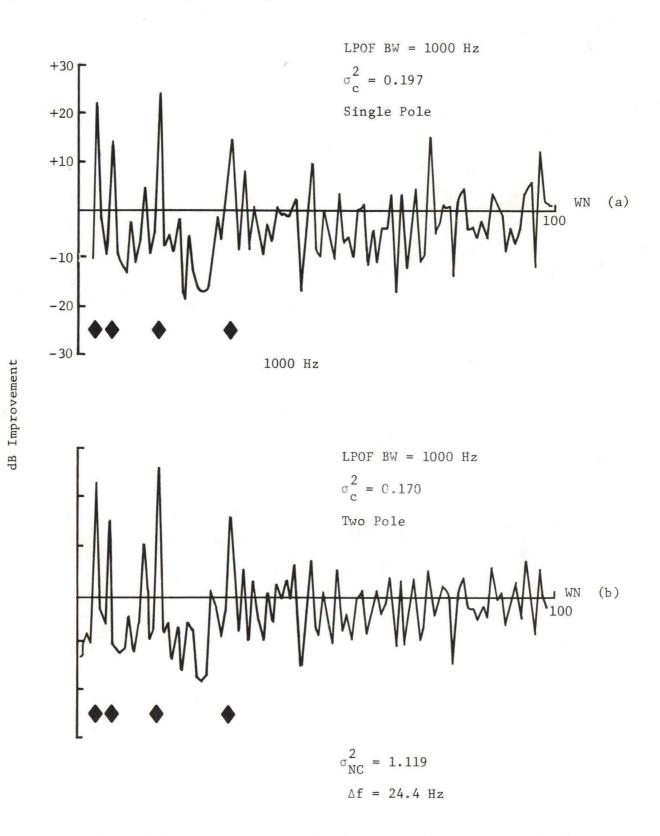
Table 5-4 shows the effect of re-instituting the four tones on the data and flutter channels in the presence of a noise background. The values presented here represent "dB improvement" as described in Appendix C. The intent is to show the trade-off of low-pass output filter bandwidth reducing the total noise on the data channel versus flutter cancellation effectiveness. Notice that as the bandwidth is reduced the cancellation ability degrades beginning at the higher tone frequencies as would be expected. The -1.0 "dB improvement" at the 417 Hz tone for a 100 Hz filter is in reality a flutter enhancement and is likely due to the odd spectral distribution of the modulated carrier which gives rise to the data interaction described previously. The 2 KHz filter provides superior cancellation performance to the lower bandwidth filters in all cases. However a reduction to 1 KHz reduces the overall noise variance and still provides acceptable cancellation. This kind of optimization of bandwidth versus performance would be more emphatic if the flutter noise was not white noise but was concentrated about certain flutter harmonics. Figure 5-3 shows the spectral distribution for the first 100 lines (\sim 2440 Hz) of the data channel output for the first three cases in Table 5-4. The flutter tones are indicated by the small diamonds below each plot. Of particular interest here is the behavior of the lines above the filter cutoff. For example, in Figure 5-3-c, wave numbers 90 and 93 have been significantly enhanced even when they are well in excess of the range of compensation. This again points out the strong data interaction due to the spectral distribution of the modulated carrier.

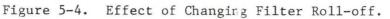
Finally, the effect of changing the roll-off rate of the low-pass output filter was investigated. Figure 5-4 shows the spectrum of Figure 5-3-b as compared with a similar situation where the order of the filter was increased from a single pole (roll-off rate of 6 dB/octave) to a two pole configuration (roll-off rate of 12 dB/octave). As would be expected, the <u>total</u> noise variance of the data channel was reduced from 0.197 to 0.170. This can be seen visually by inspecting Figure 5-4 in the region above the cutoff frequency (1000 Hz). However, notice that the cancellation effectiveness has decreased for the higher roll-off rate (note the increase in amplitude at those wave numbers marked with a diamond below each figure). This would lead one to the conclusion that significant information relative to effective cancellation is contained in wavenumbers greater than the cut-off frequency





and that the lack of this information due to a higher rate of attenuation above cut-off noticeably affects performance.





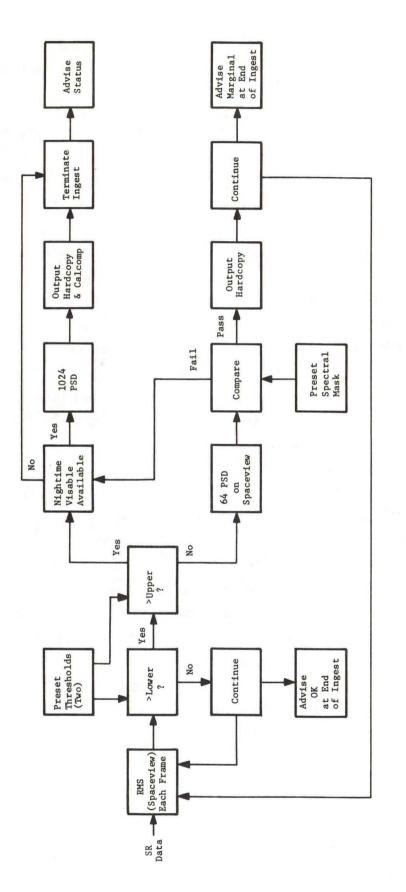


6.0 PRELIMINARY RECOMMENDATIONS FOR DIAGNOSTIC IMPLEMENTATION

The philosophy of diagnostic implementation on-line at the DDHS is constrained to be a minimum interference technique. On a routine basis it must be rapid, repetitive, and not impose on computer storage requirements. Also, during those ingests where abnormal conditions are suspected, it must be of sufficient detail to be useful in correcting any system fault which may be present. These operational and performance constraints are best met here with an approach to the diagnostic implementation which is adaptive in the degree of detail as a function of the data quality observed.

Figure 6-1 shows a flow diagram of a recommended diagnostic procedure which would accommodate the above philosophy. As a simple measure of performance, an RMS would be computed on the space view each frame during ingest. This value would then be compared with a preset threshold. The threshold would represent the maximum noise level for which average or above average data quality could be assured. In the event the RMS was lower than the threshold, the ingest would continue and the operator advised of a normal condition at the termination of the ingest. In the event the RMS is greater than this threshold, it would be compared to a second (higher) threshold which would represent the maximum RMS noise which would assure the minimum acceptable data quality. If the RMS was lower than this threshold, a 64 sample power spectrum would be computed on the space view. The spectrum would be compared to a stored reference mask to see which flutter harmonics had changed and the result output for analysis. The ingest would continue and the operator advised of marginal data quality at the termination of the ingest. If, on the other hand, the RMS exceeded the maximum acceptable noise level, more detailed spectral analysis would be pursued. It would be ascertained whether nighttime visible data could be obtained within the remaining data to be ingested. If so, then a 1024 sample power spectrum would be computed and output for analysis and the ingest terminated. If not, the ingest would be terminated. The operator would be advised of the status at the termination of the ingest. A decision to reingest would then be made on the status observed and available spectral data.

During the course of the study, the complete diagnostic philosophy was not incorporated for on-line evaluation during ingest. However, an initial diagnostic configuration was developed and provided to NESS personnel for





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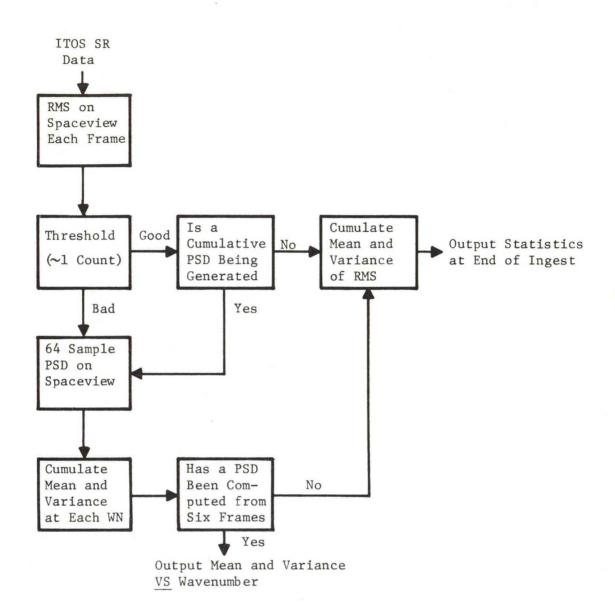
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preliminary simulation testing on the CDC 6600 at Suitland. The key elements of this configuration are shown in Figure 6-2. It is the intent of this type of approach to structure the final diagnostic configuration dynamically in order to maintain compatibility with system changes at NESS. In particular, it was not clear at the time of the conception of this configuration whether night-time visible data would be available, thus it has been deleted from the structure in such a way as to be included later if available.

The concept of performing a 64 sample power spectrum was given special attention in deriving the configuration shown. An analysis was performed to indicate the improvement in spectral stability which could be achieved by averaging. A vector of 1024 random samples with a flat spectrum was generated and its spectrum computed. This spectrum was then condensed to an equivalent 64 sample spectrum by summing the energy over groups of 16 wavenumbers. This result indicated a very flat spectrum as would be expected. The original 1024 sample data vector was then segmented into 16 independent 64-sample data sets and a spectrum computed for each. The results indicated these small sample spectra to be statistically unstable (i.e., flatness was not achieved). A cumulative average was then performed for the small sample spectra to determine the minimum number of spectra which could be averaged in order to reach a stable statistic. The average value at each wavenumber was computed with the number of spectra incorporated varying from 2 to 16. An apparently stable statistic was achieved at a minimum of six individual spectra. This cumulative average was then incorporated into the diagnostic logic.

The configuration shown in Figure 6-2 thus represents the basic cornerstone of the logic to achieve the final goal of stable compensation. It can be expanded and revised in accordance with ground system and satellite changes.

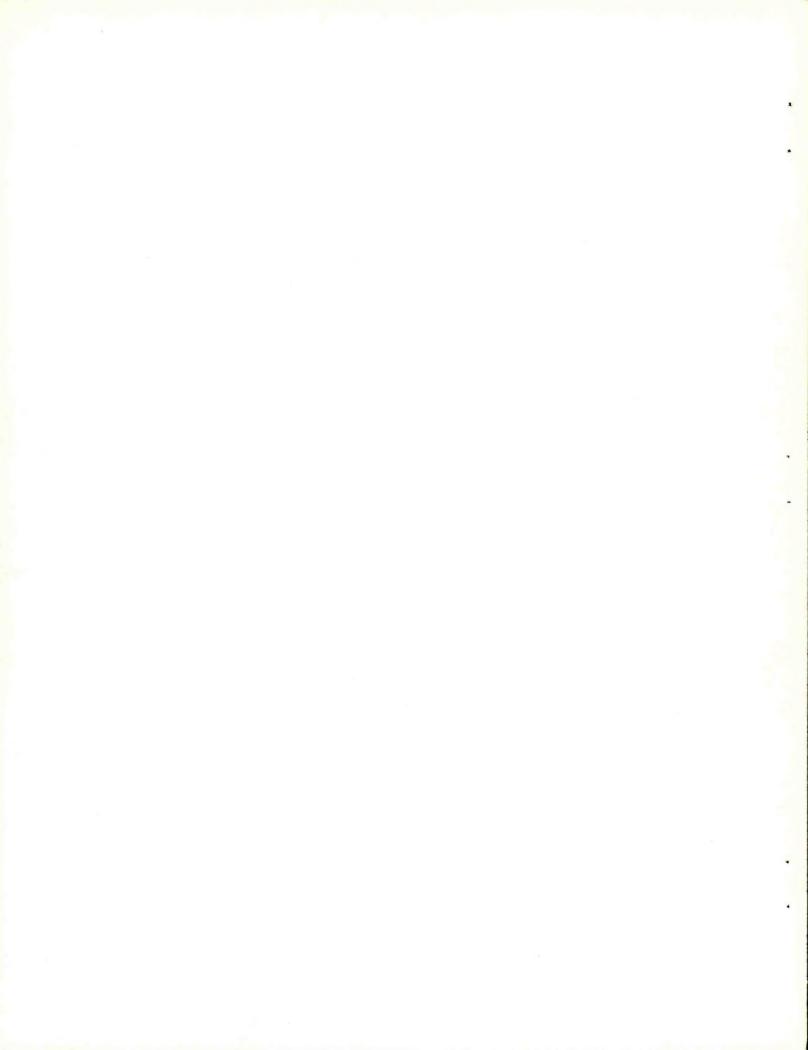


Note: Need to be sure not to compute PSD on <u>all</u> frames (i.e., upper threshold has not been incorporated) in the case of bad data.

Figure 6-2. Initial Diagnostic Configuration.

7.0 RECOMMENDED STANDARD OPERATING PROCEDURES

In order to provide a base for achieving stable overall system operation, a portion of the study was directed at preparing (in cooperation with Wallops CDA personnel) a "standardized operating procedure" for periodic alignment of the z-axis rack hardware. This effort resulted in an over detailed procedure which proved not to be viable on a day-to-day operational basis and was subsequently not formally adopted. It does represent a fairly complete technique for alignment and is included as Appendix E.



8.0 RECOMMENDATIONS FOR FUTURE EFFORT

It is recommended that the effort described in this report be continued toward the overall goal of achieving stable data quality assurance in an operational sense. Additional studies directed toward this end would include analytical investigations to quantitatively predict the effect of system changes (i.e. for future satellite configurations) on data quality and feasibility investigations to expand the scope of the diagnostic logic implementation. Additionally, close co-ordination and support is recommended during the actual operational implementation of this diagnostic logic at NESS.

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9.0 APPENDICES

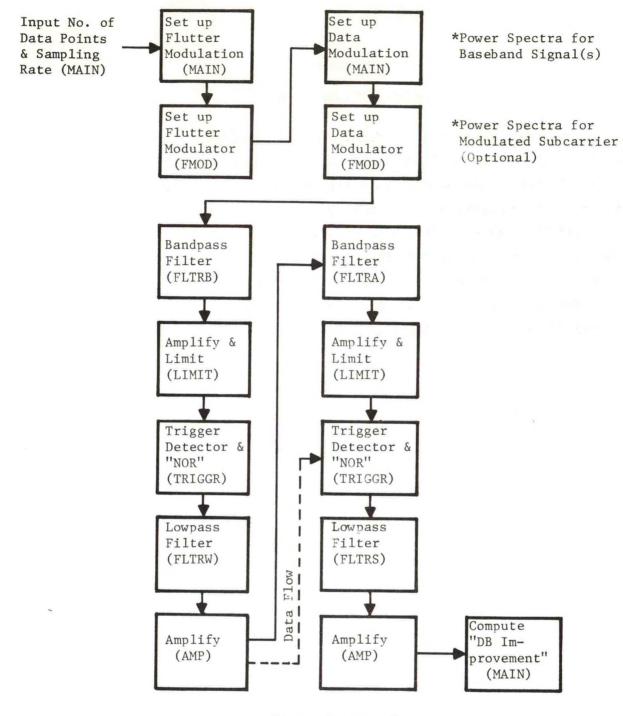
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APPENDIX A

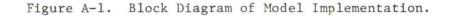
MODEL IMPLEMENTATION

This appendix presents a detailed block diagram of the digital computer algorithm which comprises the model developed during the study. A description of the model inputs follows as Appendix B, a sample output description as Appendix C, and a sample listing as Appendix D.

The block diagram indicates program control with the exception of the dotted line showing data flow for the flutter channel output. The subroutine call names are shown in parentheses. Power spectra are available as output at intermediate points in the program and are so indicated on the block diagram.



*Power Spectra for Demodulated Signal(s)



APPENDIX B

MODEL INPUT DESCRIPTION

This appendix presents the configuration of the data cards used with the model. A separate data deck must be supplied for each pass through the algorithm. The data deck must be complete within itself, and no data cards are common to multiple passes. With proper care this provides maximum program flexibility in terms of conducting analyses. For the first two passes the input bandpass filters are bypassed, and cards No. 3 and 4 as well as 22 and 23 must be removed. The parentheses following the card number indicate the calling routine. The cards are numbered sequentially but with gaps in the numbering system due to data deck modification during development. The deck was not renumbered in order to avoid confusion over the span of the study. The numbers to the left of the description indicate card column.

Data Deck Configuration

Flutter	Channel
Card Nu	mber 1 (MAIN)
1-5	Number of data points to be analyzed (Integer Format)
6-25	Period of time between data points in seconds ("F" Format)
Card Nu	mber 2 (MAIN) - Integer Format - Diagnostic
1	Enter 1 if output is to be written on paper after program has executed (the reference and data channel output signals)
Card Nu	mber 3 (FLTRB) - Integer Format - Diagnostic
1	Enter 1 if array is to be written as it appears initially in the program.
2	Enter 1 if array is to be written after it is rearranged suitably for use by the Fourier transform subroutine.
3	Enter 1 if the Fourier spectrum is to be printed.
4	Enter 1 if the filtered Fourier spectrum is to be printed.
5	Enter 1 if the inverse Fourier transform output is to be printed.
6	Enter 1 if the array is to be printed after it is rearranged to be used by other subroutines.
Card Nu	mber 4 (FLTRB) - 3F10.3
1-10	Number of poles in filter
11-20	Maximum deviation frequency
21-30	Subcarrier frequency
Card Num	mber 7 (LIMIT) – Integer Format – Diagnostic
1	Enter 1 if it is desired to write the data out after the flutter channel has been limited.
Card Nur	mber 8 (LIMIT) - "F" Format
1-10	The gain of the limiter stage before the flutter signal is limited. Must include decimal.
11-20	The gain of the limiter stage after the limiter must include decimal.
21-30	The amount of delay inherent in the limiter. Must include decimal.
31-40	The absolute value at which the signal is clipped. Must include decimal.

Card Number 9 (TRIGGR) - Integer Format - Diagnostic

- Enter 1 if it is desired to output the data after the flutter 1 channel has been examined for positive going and negative going zero crossings. Enter 1 if it is desired to output the data which consists of the 2 outputs of the A and B detectors. 3 Enter 1 if it is desired to output the data after the "NOR" circuit has "NORED" the outputs of the two detectors. Card Number 10 (TRIGGR) - "F" Format 1 - 10The triggering level of the Schmitt Trigger for increasing voltages. 11-20 The triggering level of the Schmitt Trigger for decreasing voltages. 21 - 30The delay associated with the Schmitt Trigger circuit. Card Number 11 (TRIGGR) - "F" Format 1 - 10Enter 0.0 Pulse width of detector A in seconds. 11 - 2021 - 30The delay in seconds associated with the A detector. 31 - 40The amplitude of the detector A pulse output. 41-50 The amplitude of the detector A output when no pulse is being output. Card Number 12 (TRIGGR) - "F" Format 1 - 10Enter 0.0. 11 - 20Pulse width of detector B in seconds. The delay in seconds associated with the detector. 21 - 3031 - 40The amplitude of the detector B pulse output. 41-50 The amplitude of the detector B output when no pulse is being output. Card Number 13 (TRIGGR) - "F" Format The amplitude of the "NOR" circuit output voltage when it is in the 1 - 10high state. 11 - 20The amplitude of the "NOR" circuit output voltage when it is in the low state. 21 - 30The delay in seconds associated with the "NOR" circuit. 31-40 The input level which differentiates the low level from the high level. Card Number 14 (FLTRW) - Integer Format - Diagnostic 1 Enter 1 if flutter array is to be output as it appears upon entry
- 2 Enter 1 if flutter array is to be output after it is rearranged (put in complex form) suitably for use by the Fourier transform subroutine.

to the filter subroutine.

- 3 Enter 1 if Fourier spectrum of input data is desired.
- 4 Enter 1 if the spectrum of the filtered data is desired.
- 5 Enter 1 if the inverse Fourier transform output is desired.
- 6 Enter 1 if the flutter array is to be output after the filtering operations have ended.

Card Number 15 (FLTRW) - Integer Format

- 1-3 The degree of the transfer polynomial numerator for the output flutter channel filter.
- 4-6 The degree of the transfer polynomial denominator for the output filter in the flutter channel.
- Card Number 16 (FLTRW) 5E16.8
- 1-80 The coefficients of the numerator polynomial of the output flutter channel filter, power increasing except for the constant term which is last. Additional cards may be used for high order polynomials.

Card Number 17 (FLTRW) - 5E16.8

- 1-80 The coefficients of the denominator polynomial of the output flutter channel filter, power increasing except for the constant term which is last. Additional cards may be used for high order polynomials.
- Card Number 18 (AMPL) Integer Format Diagnostic
- 1 Enter 1 if the arrays are to be output after the flutter array is amplified.
- Card Number 19 (AMPL) "F" Format
- 1-10 Enter the gain of the amplification stage.

Card Number 20 (DELAY) - Integer Format - Diagnostic

1 Enter 1 if the arrays are to be output after the flutter array is delayed (advanced, see Card No. 21).

Card Number 21 (DELAY) - "F" Format

1-10 The time in seconds by which the flutter channel signal is advanced with respect to the signal (effectively a positive error in main delay setting).

Card Number 21A (DELAY) - Integer Format - Diagnostic

1 Enter 1 if the arrays are to be output after the signal array is delayed (advanced, see Card No. 21B).

Card Number 21B (DELAY) - "F" Format

1-10 The time in seconds by which the signal channel is advanced with respect to the flutter (effectively a negative error in main delay setting).

Data Channel

Card Number 22 (FLTRA) - Integer Format - Diagnostic

1	Enter 1 if signal and "A" array are to be written as they appear initially in the program. Useful only for debugging program.
2	Enter 1 if signal array is to be written after it is rearranged suitably for use by the Fourier transform subroutine.
3	Enter 1 if the Fourier spectrum of the signal data is to be printed.
4	Enter 1 if the filtered Fourier spectrum is to be printed.
5	Enter 1 if the inverse Fourier transform output is to be printed.
6	Enter 1 if the array is to be printed after it is rearranged to be used by other subroutines.
Card Nu	mber 23 (FLTRA) - 3F10.3
1-10	Number of poles in filter.
11-20	Maximum deviation frequency.
21-30	Subcarrier frequency.
Card Nu	mber 26 (LIMIT) - Integer Format - Diagnostic
1	Enter 1 if it is desired to write the signal data out after it has been limited.
Card Num	mber 27 (LIMIT) - "F" Format
1-10	The gain of the limiter stage before the signal channel is limited. Must include decimal.

- 11-20 The gain of the limiter stage after the limiter. Must include decimal.
- 21-30 The amount of delay inherent in the limiter. Must include decimal.
- 31-40 The absolute value at which the signal is clipped. Must include decimal.

Card Number 28 (TRIGGR) - Integer Format - Diagnostic

- 1 Enter 1 if it is desired to output the data after the signal channel has been examined for positive going and negative going zero crossings.
- 2 Enter 1 if it is desired to output the data which consists of the outputs of the A and B detectors.
- 3 Enter 1 if it is desired to output the data after the "NOR" circuit has "NORED" the outputs of the two detectors.

Card Number 29 (TRIGGR) - "F" Format

1-10 The triggering level of the Schmitt Trigger for increasing voltages.

11-20 The triggering level of the Schmitt Trigger for decreasing voltages.

21-30 The delay associated with the Schmitt Trigger circuit.

Card Number 30 (TRIGGR) - "F" Format

1-10 The ratio of the detector A pulse width output to the magnitude of the wow and flutter channel, i.e., the "coefficient" determined by

> detector pulse width = "coefficient" × flutter magnitude + nominal detector pulse width.

- 11-20 The nominal pulse width detector A (see expression above).
- 21-30 The delay in seconds associated with the A detector.
- 31-40 The amplitude of the detector A pulse output.
- 41-50 The amplitude of the detector A output when no pulse is being output.

Card Number 31 (TRIGGR) - "F" Format

- 1-10 Ratio of the detector B pulse width to the magnitude of the wow and flutter signal. See corresponding entry in card number 30.
- 11-20 The nominal pulse width of detector B. See corresponding entry in card number 30.
- 21-30 The delay in seconds associated with the B detector.
- 31-40 The amplitude of the detector B pulse output.
- 41-50 The amplitude of the detector B output when no pulse is being output.

Card Number 32 (TRIGGR) - "F" Format

- 1-10 The amplitude of the "NOR" circuit output voltage when it is in the high state.
- 11-20 The amplitude of the "NOR" circuit output voltage when it is in the low state.
- 21-30 The delay in seconds associated with the "NOR" circuit.
- 31-40 The input level which differentiates the low level from the high level.

Card Number 33 (FLTRS) - Integer Format - Diagnostic

- 1 Enter 1 if signal array is to be output as it appears upon entry to the output filter subroutine. Useful for debugging only.
- 2 Enter 1 if flutter array is to be output after it is rearranged (put in complex form) suitably for use by the Fourier transform subroutine.
- 3 Enter 1 if the spectrum of data is desired.

- 4 Enter 1 if the spectrum of the filtered data is desired.
- 5 Enter 1 if the Fourier transform output is desired.
- 6 Enter 1 if the flutter array is to be output after the filtering operations have ended.

Card Number 34 (FLTRS) - Integer Format

- 1-3 The degree of the transfer polynomial numerator for the output signal channel filter.
- 4-6 The degree of the transfer polynomial denominator for the output filter in the signal channel.

Card Number 35 (FLTRS) - 5E16.8

1-80 The coefficients of the numerator polynomial of the output signal channel filter, power increasing except for the constant term which is last. Additional cards may be used for high order polynomials.

Card Number 36 (FLTRS) - 5E16.8

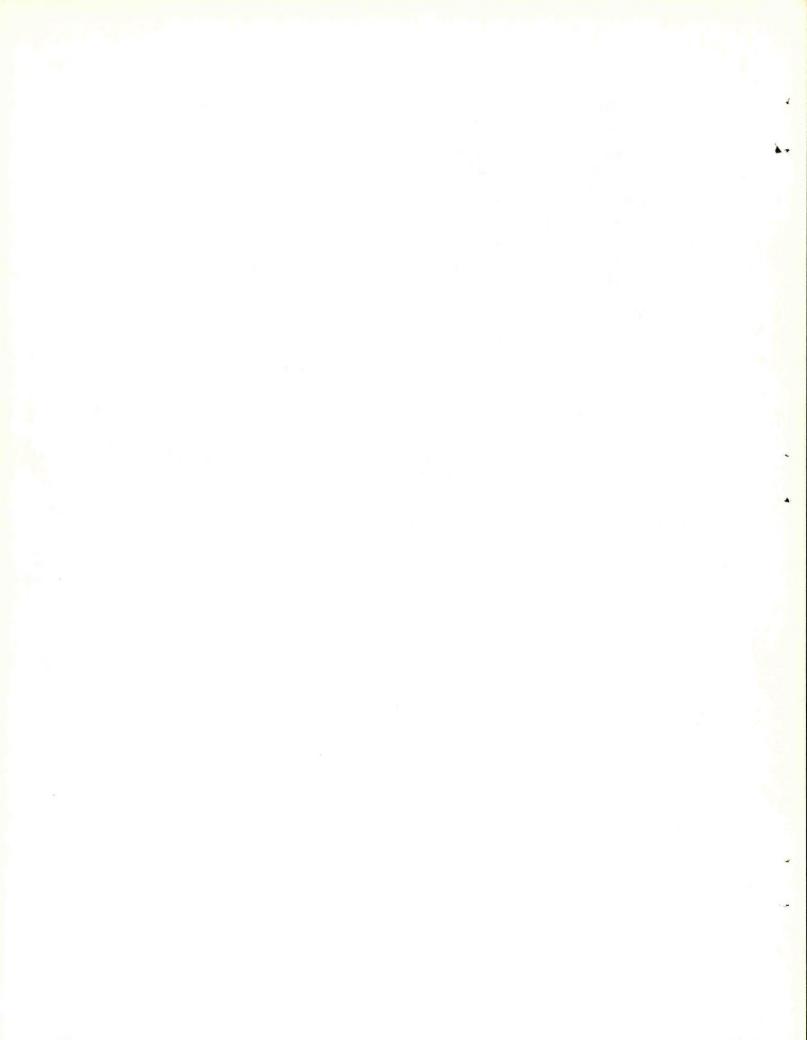
1-80 The coefficients of the denominator polynomial of the output signal channel filter, power increasing except for the constant term which is last. Additional cards may be used for high order polynomials.

Card Number 37 (AMPL) - Integer Format - Diagnostic

1 Enter 1 if the arrays are to be output after the signal array is amplified.

Card Number 38 (AMPL) - "F" Format

1-10 Enter the gain of the amplification stage.



APPENDIX C

STANDARD OUTPUT FORMAT

This appendix indicates the data output format from the model. Also available is a description of the input parameters (which has not been included here). As described in Appendix B, intermediate diagnostic output is also available as an option.

The basic parameter of interest in model performance is "dB Improvement" across the spectral band. This is defined as

20 $\log_{10} \frac{A_n(\text{without compensation})}{A_n(\text{with compensation})}$

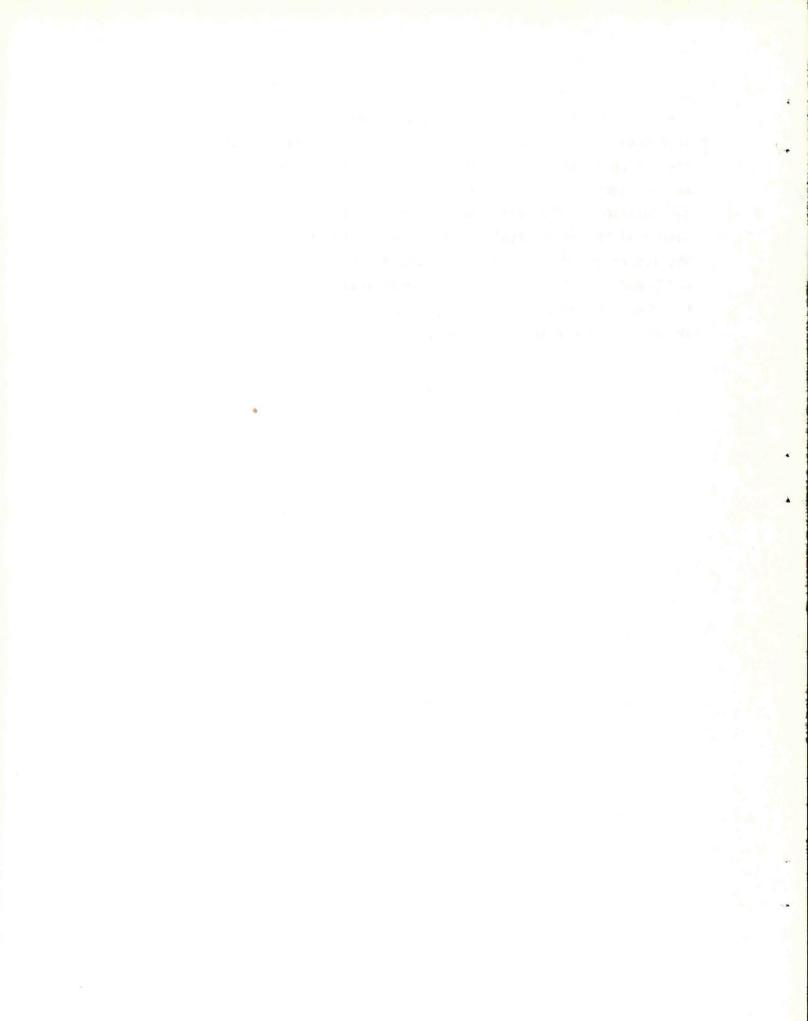
where A_n is the <u>amplitude</u> of the "n"th harmonic in a spectral analysis of the data channel output. The spectrum for no compensation is generated during the first pass through the algorithm and stored. The above computation is provided for each subsequent pass desired.

Figure C-1 indicates the output format. The first column represents the wavenumber with wavenumber 1 being the "DC" term. The spectrum is computed using the Fast-Fourier transform method and incorporates 4096 data points at a sampling rate of 10 μ sec which corresponds to a Δf of 24.4 Hz at the DDHS. The second column represents the frequency in hertz at the spacecraft during record (i.e., real time), while the third column represents the frequency in hertz as seen at the DDHS during 4:1 playback from the CDA. (Recall that there is a 20.833:1 recorder speed increase during sate1lite readout.) The fourth column represents the spectral amplitude in counts for the no-compensation case and the fifth column the spectral amplitude in counts for the compensated case. Note that the flutter tones referred to in Section 5.0 appear at wavenumbers 5, 8, 18, and 33. The sixth column represents the "dB Improvement" mentioned above. In order to provide a feeling for what the magnitude of these numbers means, a 20 "dB Improvement" would indicate that the flutter harmonic has been reduced to one-tenth its original amplitude. Correspondingly, a 40 "dB Improvement" would indicate a reduction of the flutter harmonic amplitude to 1% of its original amplitude. Negative values indicate flutter enhancement. It should be noted that for the case presented,

4																																												
DB-IMP 4.818	-4.375	-7.124	-5.188	4-506	-8.382	-7.157	-2- 003	5.356	-2-070	-6.614	-1.944	-11 301	3.992	-1.152	-8.595	-5. 176	-1.712	-5. 269	-3.889	-2.079	-2.894	-0.853	-2.987	-2.077	-5. 84 T	-3.735	1.699	0110	1.980	0-642	-1.018	-0.873	-0-747	-1-948	5.643	-16.666	-0-819	-4.105	-4- 027	-4.500	-0.441	4.263	1.345	
Z-COR 0.013	0-011	0.011	0-025	0-013	0.019	0.015	0.018	0-014	0.007	0.021	0.012	0.008	0.011	0-005	0.024	0-014	0.013	0.017	0-021	0.021	0.009	0-025	0.016	0-023	070-0	0.013	0.021	0-029	0.008	0.015	0-014	0-035	0.015	0.019	0.008	110-0	0.015	210-0	0.024	0.017	0.013	0.003	0.015	
N0-2 0.023	0-007	0.005	0.014	0.022	0-007	0.006	*10°0	0.027	0-006	0.010	600-0	110.0	0.018	0-004	600.0	0.008	0-011	0.009	0-023	0.016	0.006	0.023	0.012	0.018	0-010	0.008	0.026	0.031	0.010	0.016	0-016	0.032	0-014	0.015	0.015	0-002	0.034		0.015	0.010	0.015	0.005	110.0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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-146.753	-37-930	-38.040	-33-951	-30.674	12-032	-33.030	-25-342	-19.199	-30.521	-26.555	-27-743	-21.237	31.856	-33.242	-18.346	-15.502	-11.884	-25-449	-13.846	-14.270	-12.825	-21-526	-9.953	-9.967	-15.722	1.231	-6.474	-13.384	-3.551	-15.054	-14.072	0.996	-16-687	-9-961	-8.919	-12.600	8412 -0	-9-951	-10.841	-15.906	-12.314	-3.735	-1-804	7755
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Figure C-1. Sample Model Output Format.

the reference discriminator output gain was slightly misaligned resulting in a small "DC" component to be introduced into the data channel during the compensation process. For this reason the -146.753 "dB Improvement" of wavenumber 1 should be ignored. Columns 7 through 12 represent a continuation of the data presented in 1 through 6. Since 4096 samples were used in the spectral analysis, 2048 harmonics were generated with a Nyquist frequency of 50,000 Hz. This is well beyond the data channel bandwidth and only frequencies out to approximately 3000 Hz (wavenumber 120) at the DDHS were output. This adequately covers the band of interest for analysis of the z-axis rack operation.



APPENDIX D

SAMPLE PROGRAM LISTING

This appendix includes a sample listing of the digital algorithm used during this study. The model was programmed in Fortran IV - G level for an IBM Systems 370/65 located at the Triangle Universities Computation Center in the Research Triangle Park, N. C. The system log and source module map have been retained in the listing for completeness.

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CALL FNOUTATON PO=25000.0 DEVIA=3375.0 DEVIA=3375.0 CALL FNOUFFO.PEVIA.0.NUNBER) C 2 NART(1AMELTUDE SPECTRA FOR C 125 FORMAT(1AMELTUDE SPECTRA FOR C 125 FORMAT(1AMELL, NUMBER, NNUMA) C 525 CONTINUE C CALL PSD(SIGMAL, NUMBER, NNUMA) C 525 CONTINUE C CALL MATE(NICHT) 535 CONTINUE S35 CONTINUE CALL LIMIT(PERIOD, 1, NUMBER) CALL LIMIT(PERIOD, 1, NUMBER)	C SEL UF AND ULATOR PO-25000 0 DEVIA = 3375.0 CALL FHOD (FO, DEVIA, 0, NURBER) 12 CONTINUE C IP (KK.GT.1) GO TO 525 C IP (KK.GT.1) GO TO 525 C STLFE(3,125) C 125 FORMAT (1AMELITUDE SPECTRA FOR C S25 CONTINUE C S2		
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CALL FROD (FO, DEVIA, O, NUBBER) 12 CONTINUE C LIF(KK.GT.1) GO TO 525 C HETE(3,125) C 125 PORTAT('AMPLITUDE SPECTRA FOR C 125 PORTANUE C 525 CONTINUE C 525 CONTINUE C 525 CONTINUE C 525 CONTINUE C 525 CONTINUE CALL LETTER(FERIOD, 1, NUBBER) CALL LINIT(FERIOD, 1, NUBBER) CALL LINIT(PERIOD, 1, NUBBER) CALL LENE (S 1) CALL LETTER (FERIOD, 1, NUBBER) CALL LENE (FERIOD, 1, NUBBER)	CALL FROUTEND 12 CONTINUE C IF(KKK.GT.1) GO TO 525 C IF(KKK.GT.1) GO TO 525 C 125 FORMAT('IAMPLITUDE SPECTRA FOR C 125 FORMAT('IAMPLITUDE SPECTRA FOR C 525 CONTINUE C 525 CONTINUE C ALL WARTE(NEIGHT) C 525 CONTINUE C ALL WARTE(NEIGHT) C CALL WARTENDE, NUMBER, NWUMA, C CALL FITEREFERIO, NUMBER, NWUMA,		
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C LICHTRK.GT.1) GO TO 525 C HRITE(3,125) C HRITE(3,125) C 2125 PORMAT(1AMPLITUDE SPECTRA FOR C 2125 PORMAT(1AMPLITUDE SPECTRA FOR C 525 CONTINUE C 525 CONTINUE C CALL HRITE(NZIGHT) IF(KKK.LL2.2) GO TO 535 CALL HRITE(PERIOD, NUMBER, NMUMA, 535 CONTINUE FITE(3,1) CALL LINIT(PERIOD, 1, NUMBER) CALL LINIT(PERIOD, 1, NUMBER) CALL LENGGR(PERIOD, 1, NUMBER) CALL ABPL(1, NUMBER)	C ITY(KK.GT.1) GO TO 525 C HRITE(3,125) C 125 PORMAT('1AMFLITUDE SPECTRA FOR C 2125 PORMAT('1AMFLITUDE SPECTRA FOR C 252 CONTINUE C 525 C		
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C 125 FORMAT(114) C 225 FORMAT(114) C 525 FORMAT(114) C 525 FORMAT(114) C 525 FORMAT(114) C 525 CONTINUE FORK.L2.2) GO TO 535 C 525 CONTINUE CALL FITEB(FERIOL, NUHBER, NMUHA. 535 CONTINUE CALL LIMIT(FERIOD, 1, NUHBER) CALL ABPT(1, NUHBER)	C 125 FORMAT('1AMPLITUDE SPECTRA FOR C 225 FORMAT('1AMPLITUDE SPECTRA FOR C 525 CONTINUE C 525 CONTINUE C CALL WATE(NEGHT) C CALL WATE(NEGHT) IF(KKK.LE.2) GO TO 535 CALL FLIRGFERTO. NUMBER, NWUMA.		
C CALL PSD SIGNAL, NUMBER, NNUMA) C 525 CONTINUE C 525 CONTINUE C 525 CONTINUE C 525 CONTINUE FRKKLEJ, 60 T0 535 CALL FLTEB(FERIOL, NUMBER, NNUMA, 535 CONTINUE CALL LIMIT(FERIOL, 1, NUMBER, NNUMA, CALL LIMIT(FERIOL, 1, NUMBER) CALL LIMIT(FERIOL, 1, NUMBER) CALL LIMIT(FERIOL, 1, NUMBER) CALL LIMIT(FERIOL, 1, NUMBER) CALL LIMIT(FERIOL, 1, NUMBER)	C CALL PSD (SIGNAL, NUMBER, NNUMA) C 525 CONTINUE C 525 CONTINUE C ALL WRITE (NZIGHT) C TLL WRITE (NZIGHT) C TLL FUTTER (PERIO, NUMBER, NNUMA.		
C 525 CONTL WRITE (NELG C 525 CONTL WRITE (NELG CALL WRITE (NELG CALL FITRE (PERI 535 CONTINUE FRITE (3, 1) CALL LITTIGER (PERI CALL LITTIGER (PERI CALL LITTIGER (PERI CALL LABPL (1, WUH	C 525 CONTINUE C 525 CONTINUE C CALL WRITE(WEIG I [[KKK.LE.2] GO CALL FITRE(PERI	TED CARAIER')	
C 22 CONTINUE C 2LL WARTANE C CALL WARTENERENE 535 CONTINUE 98TTEL(1,1) CALL LIMIT(PERI CALL LIMIT(PERI CALL LIMIT(PERI CALL LIMIT(PERI CALL AMPL(1,400)	C 222 CONTINUE C CALL WRITE (NEIG IF(KK.LE.2) GO CALL FLTRE(FERI		
C CALL WHITE (NELG IP(KKK.LE.2) GO 535 CONTINUE 835 CONTINUE 881223,1) CALL LIMIT(PERI CALL LIMIT(PERI CALL LIMIR(PERE CALL LUEN (PERE CALL AMPL(1, NUE	C CALL WRITE (NEIG IF (KK & LE 2) GO CALL FLTRB (PERI		
IF(KK.LE.2) GO CALL FITRB(PERI 535 CONTINUE RRITE(3,1) CALL LIMIT(PERI CALL LIMIT(PERI CALL LINGR(PER CALL AMPL(1,NUE)	IF(KK%LE°2) GO CALL FLTRB(PERI		
535 CONTINUE 535 CONTINUE 9 RETE(4,1) CALL LIMIT(PERI CALL LIMIT(PERI CALL LITAN(PERI CALL AMPL(1,400)	CALL FLTRB (PERI		
535 CONT RELTE CALL CALL CALL CALL		(S°ANI	
WRITE CALL CALL CALL CALL	235		
CALL CALL CALL CALL	WRITE (3, 1)		
CALL CALL CALL	CALL LIMIT (PERI		
CALL	CALL		
CALL	CALL	INV.S)	
	CALL		

	NTWO 17 TOLOT 0	DATE = 73332	00/31/53	PAGE 0004	
	WRITE (3, 130)				
0131 0131	CALL PSD (WAP.N CALL PSD (WAP.N WRTTP (3.1)	TUDE SPECTRA FOR FLUTTER OUTPUT.) URBER, MNUMA)			
0133	IP(KKK.GT.1) GO TO 600				
0134	DO 550 I=1, NUMBER WAF(I)=0.0				
0136 550	CONTINUE				
0137 600	CONTINUE				
0139					
0140	KK.LE.2) G				
0142 635	CALL FLIGA (FERIOUS BUDDER, BEUGA, REUGO, LEVES)	CA, VAUDO, LAV 600			
0144	TRIGGE (PE				
0145	FLTRS (PER	MA, NNUMB, LNV, S)			
0146	CALL ARPL (0, NUBBER)				
0148					
6110	65				
0150	= NE + 1				
0151	5				
υ	WRITE (6, 50) (SIGNAL (II)	B, NE)			
	- H	B, NE)			
00 5CL0	D CONTINUS WRTTR (3.140)				
0155 140	FORMAT (" 1 AMPLI	OR SIGNAL OUTPUT')			
0156	NA	L, BUMBER, NNUMA)			
0157	IF(KKK.GT.1) GO TO 700		4		
0159	PTRST (T) =SPEC (T)				
0160 750					
0162 700					
0163	WRITE (3, 720)	-au a-cob	DB-THD		
	FURDALL' S/C 4/1	Z-COR DB-IMP	AUX		
0165	P BR IOL)				
0166					
0167	FGD1 = (I-1) * DF				
0168	PGD2=PGD1+60.0*DF				
0100	FSC1=FGU1+ (4.0/20.833)				
171					
0172	L0610	(1)			
0173	DB2=20.0*ALOG10 (FIRST (12) /SPI	EC (12))			
0174		. FSC1, FGD1, FIEST (I) , SPEC (I) , DB1,			
	112, FSC2, FGD2, FIRST (12), SPEC (1	IZ), 082			
	FORMAT (I4, 2F8.	4 , 2 F 8 . 1 , 3 F 10 . 3)			
ď					
0180	END				

PAGE 0005	LOCATION C1E0	LOCATION	160 174		LOCATION 3F0	418	440	454	470		LOCATION		LOCATION 2684 2721	282A				
PAGE	SYMBOL DUMF	SYMBOL	DELAYP DELAYP AMAX1		SYMBOL PERIOD	FRAX	NP1	CONSE	12		SYMBOL		SYNBOL 49 230	130				
00/31/53	LOC ATION C000	LOCATION	15C 170		LOCATION 3EC	111	4 28	450	478		LOCATION		LOCATION 267D 26FA	2788				
0	SPEC	TOBAS	AMPL		STMEOL NUMBER	82 82	APND	SMIN	PSC2		TOBMAS		SYMBOL 48 120	720				
DATE = 73332	SIZE C1E8 Location 8000	LOCATION	158 16C		LOCATION 3E8 3FC	410	438	14C	474		LOCATION 1668		LOCATION 2674 26D6	2790	D_#MAP 58 SIZE = 14296		-	
	/ MAP SYMBOL WAF	ED SYMBUL PSD	FLTR		TPI TPI	NEIGHT	FLY	SMAX	PSC1		SYMBOL	×	SYMBOL 51 220	140	IST, DECK, LOAD, ECNT = 5 180, PROGRAM SI			
MAIN	COMMON BLOCK / LOCATION 4000	SUBPROGRAMS CALLED LOCATION 1400	154 168 17C	SCALAR MAP		400	t 3t	448	470	4 84	AY MAP Location 668	MAT STATEMENT	LOCATION 266D 26B2	2767	NOL	-		
21	COR SYMBOL A	SUE SYMBOL RANDI	TRIGGR FLTRS ALOG10	301	SYMBOL PI NA	NNUMB	II	DEVIA	FGD2	DB2	ARRAI SYMBOL I INV	FORMA	SYMBOL 50 210	130	00			
G LEVEL	LOCATION 0 C1E4	LOCATION 13C	150 164 178		LOCATION 3E0 3FU	408	430	444	460	480	LOCATION 488		LOCATION 2668 268A	2744	*OPTICNS IN EFFECT* *OPTIONS IN FFFECT* *STATISTICS* SOUR *STATISTICS* OUN			
FORTRAN IV	SYMBOL SIGNAL DUMD	SYMBOL	LTMIT FLTRA AMIN1		SYMBOL KKK Turt	NNUMA	CONSD	FO	FGD1	DB1	SYMBOL FIRST		SYMBOL 1 110	240	* OPTIC * OPTIC * STATI * STATI			

C C C C C C C C C C C C C C C C C C C	POPTRAN IV G LEVEL	WEL 21	HAIN	DATE = 73332	00/31/53	PAGE 0001	
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FORT	0003	REAL+8 A (4	MAL (4090), 2 (4090), MAF (4 096), PO, DEVIA, SUM, TEMP, TOT	CONS	2		
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C NDTIENER C**** "FIX" FOR APPEN C**** "FIX" FOR APPEN C**** "FIX" FOR APPEN C**** "FIX" FOR APPEN 60 J=1,NUME 60 J=1,NUME 5 J=1,SUMES C+*** TEMENT OF ARRA C **** TEMENT OF ARRA J=J=J=-1 J=J=J=-1 C COMS= (FO*FIX=0.0 C C **** TRIGEER APPENDI C C **** TRIGEER APPEND C C **** TRIGEER APPENDI C C **** TRIGEER APPEND C C C C C C C C C C C C C C C C C C C		DDDHD = DDDDD					
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C 4 402 C 4 400 C 4 402 C 402	0020	CONS= (PO*P	T*0.00002D0*JM) +DEVIA*T	E HP*T PI			
C 4 40 C 40							
412 412 52 4*** C	0021	CONS = DMOD (CONS, TPI)				
CC	0022	DA . HOUE. EQ	Ch DI 09 (1-)				
452 440 44 440 44 440 44 440 440 440 440 4	0024	GO TO 40	(CRON) NTCH-				
C C C C C C C C C C C C C C C C C C C	0025		IN (CONS)				
22 22 24 24			DZWDAGE				
55 C****			-11 GO TO 55				
55 C****	0028	CONS= (FO*P	I*0.0002D0*NDP1) +DBVIA	* (TEMP+DDUMD) *TPI			
55 C****	0029	DUND= DSIN	(CONS)				
50 02 ** 20 C	00 30		T*0-0000200*NDP114DEVIA	* (TEM P+DDUMP) * TPI			
4* 20 C4	0032		CONSI				
* ** 0							
	0035	END					

			0,1	12	12	2.2	2002 1 20 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1
PAGE 0002	LOCATION C1E0	LOCATION	1	LOCATION 110 138	150	LOCATION	
PAGE	SYMBOL	STRBOL		SYMBOL DDUMF CONS	JE	SYMBOL	
00/31/53	LOCATION C000	LOCATION		LOCATION 108 130	14C	LOCATION	
0	SPEC	STRBOL		SYMBOL DEVIA TEMP	ſ	TOBUS	
DATE = 73332	SIZE C1E8 Location 8000	LOCATION		LOCATION 100 128	148	LOCATION	888 P 28 = 33918
	STABOL BAP	SY MBOL		SYMBOL PO SUE	NUMBER	TOBMAS	ST, DECK, LOAD, MA CMT = 58 35, PROGRAM SI 28
FHOD	COMMON BLOCK / LOCATION 4000	SUBPROGRAMS CALLED LOCATION	ALM OF LESS	COC	144 158	ARRAY MAF LOCATION	
21	ST HBOL	STABOL	U	SYMBOL TPI NDP1	B NODE	STHBOL	
G LEVEL	LOCATION 0 C1E4	LOCATION		LOCATION F0 118	140	LOCATION 160	*OPTIONS IN BFFECT* *OPTICNS IN BFFECT* *STATISTICS* NO DI *STATISTICS* NO DI
FORTRAN IV	STABOL SIGNAL DUMD	SYMBOL		SY MBOL PI DDUMD	S	SYRBOL	* 00710 * 57110 * 57110 * 57110 * 57110

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	IA C TRAFT	12	FLTRB	DATE = 13332	50/15/00	PAGE UUUT	
0001		64	RB (PERIOD, NUMBER, NNUMA, NNUMB, INV, S)				
	υų	THIS SUBROUTINE CONVE THE TIME DOMAIN TO TH	RTS THE WOW AND E FREQUENCY DOMAL	CONVERTS THE WOW AND FLUTTER DATA CHANNEL FROM TO THE FREQUENCY DOMAIN. IT THEN MULTIPLIES	I FROM		
		TBANS	FER FUNCTION WHI	TRANSFER FUNCTION WHICH IS INPUT AS A QUOTENT	OTENT		
		TIME DOMAIN	THEN THE CHANNEL	THEN THE CHANNEL IS CONVENTED BACK TO THE	TO THE		
0002		MON SIGNAL (4096) . WAF (4096)				
0003			UR, XDENOR, QUOTNT	1011 2020 1011 101			
0005		DIMENSION ODOTET (2048)	。T H (H H H H H H H H H H H H H H H H H				
0006		AMP (4096) , PHASE (4096)				
1000	000	DIMENSION CO (4096) ,0	096) "QA (4096)				
6000		PORMAT (11.10P12.7)					
0010			BANDPASS FILTER ROUTINE')				
0011	221		E DATA IS REARRA	BEFCKE DATA IS REARRANGED PROPERLY')			
0012	222		HAS NOW BEEN REARRANG	ED IN PROPER CELLS	OF ARRAY RE		
113	500	223 PORMAT ("1 OUTPUT OF FOURIER TRANSFORM")	FOURIER TRANSFORM	1.6			
0014	224	PORMAT ("1DATA AFTER	MULTIPLICATION B	HULTIPLICATION BY TRANSFER FUNCTION.)	6.		
0015			INVERSE TRANSFORMATION.)	HATION")			
0016		TA	REPACKING TO OBT.	AFTER REPACKING TO OBTAIN 3 REAL ARRATS')			
1100	230	PORMAT (213)					
6100	250	FORMAT(1H1.2T3)					
0020	233	PORMAT (18 , 5F16. 8)					
0021		-		Contra Prove			
0022			BIT, IWRIZ, THRIS, IMAI4, IWRIS, INALO, INALO, INALO	OTHAT CTEAT			
0023		TP/THRI1.EQ.1) WRITE TP/THRI1.EU.1) WRITE	WRITE(3,221) (WAP(IST),IST=1,NUMBER)	IST=1, NUMBZR)			
0025							
0026							
1200	Ľ	P ARRA	ECLARED COMPLEX.	SO THERE ARE ONLY	THO		
		S INSTEAD	EE IN THE COMMON		ARRAY		
	U	SAME SIZE	AS TWO STANDARD REAL ARRAYS.	ARRAYS. HOWEVER.	THT DATA		
		(ALL REAL DATA) IN TH	IN THE COMPLEX ANNAY IS UNLY STUNES AVITN RITH REAL AND COMPLEY CELLSI -		THEREPORE		
		DATA HUST B	BE SPREAD OUT ANONG THI	THR	HOUT THE		
		ATTEMPT HAS	BE MADE TO ACCOMPLISH THAT HERE.	THAT HERE.			
0028		L = NUABER / 2 $LL = L + 1$					
0030		5					
10031		11					
0033		IID = IIC - 1					
96 34		G = REAL (WAF (IIB))					
0035		WAP (IID) = CMPLX (G.0.0)	(0.				
0036	250	G = AIMAG (WAF (IIE)) WAR (IIC) = CMDIY (G_0_0)	10				
0038		- EQ- 1)	(3,222)				
6800			WRITE (3, 201) (WAP (IST), IST=1, NUMBER)	, IST=1, NUMBER)			
0000	א כ	TAKE THE FOURIER INAN TPSRT = 1	PROJE				
0041		HARM (WAP .	H. INV. S. IFSET, IFERR)				

0002 FUERT(A-1D) FUERT(A-200) MATE (A-223) 0004 7.30 NON (1/210) NO. 10 MATE (A/223) 0004 7.30 NON (1/210) NO. 10 MATE (A/223) 0005 1000 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 1000 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200) NO. 10 MATE (A/200) NO. 10 MATE (A/200) 0005 NO. 100 MATE (A/200)	LOUINDA LA G LEVEL	21 PLTRB	DATE = 73332	00/31/53	PAGE 0002	
17 FORMAT (IF IF		WRITE (3,17) IP			•	
IP[IHI1.24] IP[IHI1.24] 234 FORMAT (3710.3) 235 VENTE (*.233) 235 FORMAT (3710.3) 235 FORMAT (1,234) 235 FORMAT (1,210.3) 235 FORMAT (1,240.3) 236 FORMAT (1,01.4) 237 NHL 238 HEP1=MHJ 239 FORMAT (3.1.4) 230 HP1=MHJ 231 FORMAT (3.1.4) 232 FORMAT (3.1.4) 233 FORMAT (3.1.4) 234 FORMAT (3.1.4) 235 FOLV4.0) 241 COUTRT (3.1.4) 241 CONTRT (3.1.4) 243 FORMAT (3.1.4) 244 CONTRT (3.1.4) 244 CONTRT (3.1.4) 244 CONTRT (3.1.4) 244 CONTRT (3.1.4)		FORMAT (* IFI IF (IWRI3.EQ.1)				
239 FORMAT(3F10.3) 235 FORMAT(3F10.3) 235 FORMAT(7,DEW1 C**** C**** C**** C**** ML=(1.0-DEV)*F ML=(1.0-DEV)*F ML=(1.0-DEV)*F ML=(1.0-DEV)*F ML=1=NL+1 MLF1=NL+1/2 C**** MHALF=NUMBER/2 MHALF=NUMBER/2 DO 410 J=ML7/2 C**** 410 CONTINUE AMAG=COS 01(J) =AMAG=COS 01(J) =AMAG=SCIN 010CNT(J) =CMF1 010CNT(J) =CMF1		IP(IWRI3.EQ.1)	IST) , IST=1, NUMBER)			
Z35 FORMAT (* DEW=" 235 FORMAT (* DEW=" 235 FORMAT (* DEW=" C***** N= (1 - 0-DEW)*F NH= (1 - 0+DEW)*F NH= (1 - 0+DEW)*F	5	READ (1,234)				
235 FORMAT'("DEW= C***** C***** C***** NL=(1.0-DEW)*F NL=(1.0-DEW)*F NL=(1.0-DEW)*F NLDT=NL+1 NLDT=NL+						
C C C C C C C C C C C C C C C C C C C		PORMAT (' DEV='	3)			
C ***** T I I I -D AUC C ***** NL= (1.0-DEW)*F NL= (1.0-DEW)*F NLPI=NL+1 HPT=NL+1 HPT=NL+1 HPT=NL+1/2 NHALF=NUHBER/2 D0 400 J=1,NL AMAG=0_0 ATZZE=(POL/4.0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0	C***					
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MH-IF 04.023 04.023 04.04.02 MHALF=NUMBER/2 NHALF=NUMBER/2 00.04.00 05.04.00 NHALF=NUMBER/2 D0.0400 05.04.00 05.04.00 NAAAC ARAGeOCOS 00.0410 05.04.00 ARAGeOC OD0.0410 D0.0410 05.0417 ARAAC ARAAC 0000000 05.0417 ARAAC OO000000 ARAAC 05.0417 ARAAC OO000000 ARAAC 05.0417 ARAAC OO000000 ARAAC 05.0417 ARAAC OO0000000 ARAAC 05.0417 ARAAC OO00000000 ARAAC 05.0417 ARAAC OO0000000000 000000000000000000000000000000000000	0051	NL= (1.0-DEV) *PO/DELF+1.5				
RHEP = RH+1 HHP = RH+1 2 RHALF = NUMBER/2 DO 400 J=1,NL DO 400 J=1,NL ARAG=0.0 ARAG=0.0 J=1,NL ARAG=0.0 J=1,NL ARAG=0.0 ARAZE=[POL/4.0 QUOTNT (J) = CARL QUOTNT (J) = CARL QUOTNT (J) = CARL QUOTNT (J) = ARAG=COS QUOTNT (J) = CARL QUOTNT (J) = CARL QUOTNT (J) = ARAG=COS QUOTNT (J) = CARL QUOTNT (J) = ARAC QUOTNT (J) = ARAC QUOTNT (J) = ARAC QUOTNT (J) = ARAC QUONT (J) = ARAC QUONC (J) = ARAC QUONC (J) = ARAC </td <td>2500</td> <td>$MH= (1 \circ 0+DEV) \approx PO/DELP+1 \circ 5$ MID1=NI.41</td> <td></td> <td></td> <td></td> <td></td>	2500	$MH= (1 \circ 0+DEV) \approx PO/DELP+1 \circ 5$ MID1=NI.41				
BW (M H-NL)/2 C**** NHALF=NUMBER/2 D0 400 J=1,NL AMGG=0_0 AFAZE=(P0L/4.0 CO(J) =AMGG*COS OD 410 J=NLP1, AMGG=0_0 AFAZE=(P0L/4.0 AAZ	0054	NHP1= NH+1				
NHALF=NUMBER/2 NHALF=NUMBER/2 D0 400 J=1,ML AMAGGO0 AMAGGO1 AMAGGO1 AMAGGO1 QUTVT (J) = AMAGGSIM						
D0 400 J=1,WL AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 AMAG=0_0 CO(J) = AMAG=COS CO(J) = AMAG=COS D0 410 J=MLP1, AMAG=1_0						
AMAG=0_0 AMAG=0_0 CO(J) =AMAG=CASIM QUTNT (J) =CAPL QUTNT (J) =CAPL DO 410 J=MLB1, DO 410 J=MLP1, AMAG=COS CO(J) =AMAG=SIM QUTNT (J) =CAPL AMAG=SIM QUTNT (J) =CAPL QUTNT (J) =AMAG=SIM QUTNT (J) =AMAG=SIM QUTNT (J) =AMAG=SIM QUTNT (J) =AMAG=SIM AMAG=SIM AMAG=CO AMAG=SIM AMA	0057	DO 400 J=1 NT				
COLUTINUE QUALUJ = ANAG#CCN QUALUL ANAGE = 1.0 ANAGE = 0.0 ANAE ANAE ANAE ANAE	0058	AMAG=0.0				
QA(J) = AMG 451X 400 CONTINT(J) = CAPL 400 CONTINT(J) = CAPL AARGE 1 0 AARGE 1 0 AARGE 1 0 AARGE 1 0 AARGE 1 0 AARGE 1 0 AARGE 0 0 HT (J) = CAPL 410 CONTINUS 00 42 0 J = MAG 4 CO AARGE 0 J = AAG 4 CO AARGE 0	0060	AFA2E= (PUL/4.0) * 3. 14139 CO(J) = AMAG*COS (AFA2E)				
QUORTIN (J) = CAPI 400 CONTINUE D0 410 J=NLP1, ARAG=1.0 ARAG=1.0 ARAG=C0 C(J) = ARAG=COS QA(J) = ARAG=COS ARAG=COS QA(J) = ARAG=COS QA(J) = ARAG=C	0061	QA(J) = ANAG*SIN (APAZE)				
400 410 JmLP1, D0 410 JmLP1, ARAG=1.0 CONTNUC CONTNUC ARAG=51.0 CONTNUC JmLP1, QA(J) = AMAG=51.0 CONTNUC JmLP1, QA(J) = AMAG=51.0 DO QOOTNT(J) = CMP1, QA DO QOOTNT(J) = CMP1, AMAG=0.0 ARAG=COS CONTNUC AMAG=0.0 ARAG=COS QOOTNT(J) = CMP1, C WATTE J = AMAG=COS C WATTE J = QOO C WATTE J = QOO C VATE J = QOO C VATE J = QOO C VATE J = CONJG C VATE AAO C VATE J = CONJG C VATE J = CONJG C VATE AAO C VATE J = CONJG C VATE J = CONJG C VATE J = CONJG AAO VATE CO		QUOTNT (J) =CAPL				
ARAGET.0 ARAGET.0 CC(J) = ARAGACSTN QA(J) = ARAGACSTN QA(J) = ARAGACSTN QA(J) = ARAGACSTN QA(J) = ARAGACSTN DO 420 J= ARAGACST ARAGE 0.0 ARAGEC0 CC(J) = ARAGACST CC(J) = ARAGACST CC(J) = ARAGACST CC(J) = ARAGACSTN CC(J) = ARACACSTN CC(J) = ARACAC		DO 410 J=NLP1.				
AFAZEE = [001.4.0 CO(J) = AMAG4=COS QA(J) = AMAG4=COS QA(J) = AMAG4=SOS QA(J) = AMAG4=SOS QD 420 J = AMAG4=SIN PD 420 J = AMAG4=SIN AFAG6=0.0 AFAG6=0.0 AFAZE= AFAZE CO(J) = AMAG4=OS QA(J) = AMAC4=OS QA(J) = AMAC4=OS	0065	AMAG=1.0				
QUOUNT WT (J) = AAAGesTUN QUOT WT (J) = AAAGesTUN QUOT WT (J) = CAPL QUOT WT (J) = CAPL AAAE = AFAE = AFAE AAAE = AAAGSTIN AAAE = AAAGSTIN C AAAE = AAAGSTIN C + *** DO 42 5 J= , WHA AAAE (J) = WAIT (J, BFI5 C + *** DO 42 5 J= , WHA AAAE (J) = WAIT (J) = WAAE C + *** DO 42 5 J= , WHA AAAE (J) = WAIT (J) = WAAE AAAE (J) = WAAE (J) * 425 CONTINUE AAAE (J) = WAAE (J) * 425 CONTINUE AAAE (J) = WAAE (J) * AAAE (J) = AAAAE (J) = AAAE (J) * AAAAE (J) = AAAAE (J) = CONJEC AAAAE (J) = WAAE (J) * AAAE (J) = AAAE (J) * AAAE (J) = AAAE (J) * AAAE (J) = AAAE (J) = AAAE (J) * AAAE (J) * AA	0066	AFAZE = (POL/4.0) * 3. 14159* (FO/DELF	+1-J)/BW			
410 CONTRTUB 410 CONTRTUB ABAG=0.0 Jarrel AFAZE= POL/4.0 AFAZE= POL/4.0 AFAZE= POL/4.0 AFAZE= POL/4.0 AFAZE= POL/4.0 AFAZE= POL/4.0 AFAZE= AFAZE CONTINUE AFAG*SIN QUOTNT(J)= AFAC*SIN QUOTNT(J)= AFAC*SIN QUOTNT(J)= AFF(J) QUOTNT(J)= <t< td=""><td>0068</td><td>CU(J) = ARAG*CUS (AFAZE) DA(J) = AMAG*STN(AFAZE)</td><td></td><td></td><td></td><td></td></t<>	0068	CU(J) = ARAG*CUS (AFAZE) DA(J) = AMAG*STN(AFAZE)				
410 CONTINUE 00 420 JahlP1, AFAGE=0.0 AFAGE AFAGE=0.0 AFAGE=0.0 AFAGE=0.0 AFAGE AFAGE AFAGE AFAGE AFAGE	0069	QUOT NT (J) = CMPLX (CO (J) , QA (J))				
DO 422 J J HALP1, ARAG=0.0 AFAZE= FPL/4.0 AFAZE= FPL/4.0 AFAZE= FPL/4.0 AFAZE= FPL/4.0 AFAZE= FPL/4.0 AFAZE= FPL/4.0 AFAZE= FACOS C (J) = AAG4SCIN C + *** D 425 CONTINUE C + *** D 425 CONTINUE C + *** D 425 CONTINUE C + *** D 425 CONTINUE C + *** D 0 425 J = 1, AHA C + *** C + ***C + *** C + **** C + ***C		CONTINUE				
AFAZE = (POL/4.0 AFAZE = AFAZE CO(J) = AAAG4SCIS CO(J) = AAAG4SCIS COUTINUE C = AFAC C = AFTE (3,240) (C = 240 PORMAT(12,8P15 C = 410 PORMAT(12,8P15 C = 410 PORMAT(12,9P15 C = 410 PORMAT(12,9P15	1100	DO 420 J=NHP1,NHALF				
AFAZE=AFAZE CO(J) = AAAGCeCOS Q(J) = AAAGCeSCOS Q(J) = AAAGCeSCOS Q(J) = AAAGCeSCOS Q(J) = AAAGCeSCOS Q(J) = AAAGCeSCOS COUTINUE C+*** DO 425 J=1, MHA C+*** DO 425 J=1, MHA DO 420 J=2, MHA C+*** DO 420 J=2, MHA C+*** DO 420 J=2, MHA C+*** DO 420 J=2, MHA C+*** DO 420 J=2, MHA DO 420 J=2, MHA DO 420 J=2, MHA C+*** C**** DO 420 J=2, MHA C**** DO 420 J=2, MHA DO 420 J=2, MHA C**** C**** DO 420 J=2, MHA DO 420 J=2, MHA DO 420 J=2, MHA DO 420 J=2, MHA DO 420 J=2, MHA C**** DO 420 J=2, MHA DO 420	0073	(0-4/TO				
CO(J) = AMGG*SIN Q(J) = AMGG*SIN Q(D) NT (J) = CAPL Q(D) NT (J) = CAPL Q(D) NT (J) = CAPL Q(D) NT (J) = CAPL C + *** C + *** APF(J) = MALF(J) + *APL C + *** APF(J) = MALF(J) + *APL APF(J)	0074					
QODYNT(J)=CMPL 420 CONTINUE C #BLTE(3,333) C #BLTE(3,240) (C WRITE(3,240) (C WRITE(3,320) (C WAP(3) = WAP(3) * HAP WAO = UUMBSH-3+2 HAP WAO = CONJG GHP1 = WHALF1 HAP(EP1) = CONJG C WAP (MHO) = CONJG C WAP (MHO) = CONJG	0075	CO(J) = A MA G * COS (A F A Z E) O A (J) = A MA G * S T N (A F A Z E)				
420 CONTINUE C WHITE(3,233) C WHITE(3,240) (C WHAT(11,68715) C WHAT(11,68715) C WHAT(11,68715) C WHAT(11,105 C WAP(J) = WAP(J) * 425 CONTINUE 0 425 J = 2,04A NOG=NUMBER-J5 HAA 0 4AP(MO) = CONJG HAAL 0 4AP(100) = CONJG HAAL 0 4AP(100) = CONJG HAAL C**** WAP(MP1) = WHAL*11	0077	QUOT NT (J) = CMPLX (CO (J), QA (J))				
C WRITE (3,240) (C WRITE (3,240) (C 240 PORMAT (12,8P15 C**** D0 425 J=1,8MA 425 CONT NUE D0 430 J=2,MAA NO0 HA10 HB2F-J+2 430 HA17 (NNO) =CONJG 440 HA17 = NHALF+1 C**** MALE HALE+1	* U	CONTINUE				
C RRITE(3,240) (C 240 FORMAT(11,6F15 C**** D0 425 J=1,8HA 425 CONTINUE 425 CONTINUE NOCHIONE-2,8HA NOCHIONE-2,8HA 100 420 J=2,8HA 100 420 J=1,8HA 100 420 J=2,8HA 100 420 J=2,8HA 100 420 J=2,8HA 100 420 J=2,8HA 100 420 J=2,8HA 100 420 J=100 420 J=2,8HA 100 420 J=2,8HA 1	c	WRITE (3, 233)				
C**** D0 425 J=1, NHA 42F(J) = M4F(J) * 425 CONTINUE 2, NHA 425 CONTINUE 2, NHA NNO=NUMEEF-J+2 430 MARF(NNO) = CONJG 6HP1 = NHALF+1 C****	C 240	WRITE (3, 240) (PORMAT (1X, 8F15				
D0 4/2 J = 4, MHA 4/2 F (J) = 4/2 (J) + 4/2 C CONTINUE (J) + 4/2 D 0 4/3 0 J = 2, MHA NO(= NUMBER-J+2 4/3 0 4/3 F (NO) = CONJG 4/3 0 4/3 F (NO) = CONJG	ĉ					
425 CONTINUE 14 425 CONTINUE 14 DO 430 J=2,MHA NNO=NUMBER-J+2 430 HAF(NNO) CONJG 6HP1=NHALF+1 C****	0019					
D0 430 J=2, NHA NNO=NUMBER-J+2 430 4AF (NNO)=CONJG MHP1=NHALF+1 HAR (MHP1)=CAPL C****		CONTINUE				
NNO = NU AND = CONJG 430 4AP (NNO) = CONJG ARP1 = NHALP+1 AAP (MHP1) = CAPL C****	0082	DO 430 J=2,NHALF				
400 HAR (HED) - COROS HED] = HEALF+1 HAP (HEP) = CHPL C+***		Z+D-HIRRINA AND				
WAP (MHP1) =CMPL C++++		MHP1=NHALF+1				
Ceteber		WAP (MHP1) =CMPL				
	0 + + +					

10891 2500-0.0 0000 2000-0.14 MLAF 0000 2000-0.0 0001 1701-0.0250 MD1-1.07.2500 00 70 500 0001 1712-0.2550 MD1-1.07.2500 00 70 500 0001 1712-0.2550 MD1-1.07.2500 00 70 500 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0001 515 00.0 0012 500 00.0 0013 515 00.0 0014 515 00.0 0015 515 00.0 0016 515 00.0 0017 515 00.0 0018 515 00.0 0019 515 00.0 00100 515 00.0	ZERO-0.0 ZERO-0.0 Do 500 Jan, WALK Zero(J) Zero(J) Zero(J) Zero(J) Zero(J) Tr(L: DO.ZERO.MD. F.GT.ZERO) GO TO 550 Tr(L: DO.ZERO.MD. F.GT.ZERO) GO TO 540 GO TO 500 Sto Factor Sto Factor <	FORTRAN IV G LEVEL	L 21 FLTRB	CRB	DATE = 73332	00/31/53	PAGE 0003	
<pre>x=000 J=1, MALF x=01(3) MAP(1)=08T(***1**2) TF(1: 80.28E0.AMD.1.1.E.2.8E0) G0 T0 540 TF(1: 80.28E0.AMD.1.1.E.28E0) G0 T0 540 G0 T0 560 G0 T0 560 FMARE (J)=770.0 G0 T0 560 FMARE (J)=770.0 G0 T0 560 FMARE (J)=770.0 G0 T0 560 FMARE (J)=770.0 G0 T0 560 G0 T0 560 G0</pre>	Do 500 J=1, MALF rec0(3) Ter(1: S0. ZERO.AND.T.C.G. ZERO) GO TO 540 TF(1: S0. ZERO.AND.T.C.G. ZERO) GO TO 540 TF(1: S0. ZERO.AND.T.C.G. ZERO) GO TO 540 GO TO 560 500 FILSE (2)=70.0 500 FILSE (2)=70.0	0087	ZER0=0.0					
Triation Triature Triatu	Training Training Trian Trian	0088	DO 500 J=1, NHALF X=CO(J)					
<pre>TAR (1) = SQR (AP2,1FX, ZERO) GO TO 550 TAR (2) = SQR (AP2,1FX, ZERO) GO TO 545 TE(X, EQ, ZERO, APD,Y,1F, ZERO) GO TO 540 540 FEASE (1)=270.0 540 FEASE (1)=00.0 540 FEASE</pre>	<pre>Mrg(J) = SORT (***+1**2) IF (1: SO: ZERO.AND. Y.LT. ZERO) GO TO 540 IF (1: SO: ZERO.AND. Y.LT. ZERO) GO TO 540 Sto TO 500 Sto T</pre>	0600					*	
17 (1. EXCREMENTANCE FORMER	11 11 11 12 <td< td=""><td>1000</td><td></td><td>01 00</td><td></td><td>To a state of the second second</td><td></td><td></td></td<>	1000		01 00		To a state of the second second		
<pre>If(L E0.ZEB0.AUD.Y.LT.ZEB0) G0 T0 540 640 PHASE (J)=270.0 540 PHASE (J)=270.0 540 PHASE (J)=90.0 550 PHASE (J)=1,512 5 50 PHASE PHASE PHASE PHASE 5 50 PHASE PHASE PHASE 5 50 PHASE PHASE PHASE 5 50 PHASE 5 50 PHASE PHASE 5 50 PHASE PHASE 5 50 PHASE 5 5 50 PHASE 5 5 50 PHASE 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5</pre>	If(L E0.2EB0.ABD.Y.LT.ZEB0) G0 T0 540 540 PHASE (J)=270.0 540 PHASE (J)=270.0 547 EASE (J)=0.0 550 PHASE (J)=90.0 550 PHASE (J)=50.0 550 PHASE (J)=140.0 500 PHASE (J)=140.0 <td>2600</td> <td>IF (X. EQ. ZERO. AND. Y. EQ. 2</td> <td>GO TO</td> <td></td> <td></td> <td></td> <td></td>	2600	IF (X. EQ. ZERO. AND. Y. EQ. 2	GO TO				
540 60 T0 500 547 60 T0 500 548 582 (J) = 47.84 (Y.M.) 550 548 (J) = 47.84 (Y.M.) 550 548 (J) = 47.84 (Y.M.) 550 548 (J) = 47.84 (Y.M.) 550 560 (T.G. C.S.280) (G) T (Y.G. G. T.S.280) (G) T (Y. G. C.S.280) (G) T (Y. G. C.S.29) (G) T (Y. G. C.S.79) (G) T (Y. C. C.S.79) (G) T (Y. G. C.S.79) (G) T (Y. C.	540 5415 20.0 550 751.250.0 550 751.250.0 550 751.250.0 550 751.250.0 550 751.250.0 550 757.250.0 550 757.250.0 550 757.250.0 550 757.250.0 550 757.250.0 717.17.2280.0 520.0 720.0 500 500 757.250.40.0 500 757.250.40.0 500 757.250.40.0 501 77.20.510.0 502 500 500 750.00 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 500 700.0 <tr< td=""><td>0094</td><td>IP (X. EQ. ZERO. AND. Y.LT. Z</td><td>GO TO</td><td>0</td><td></td><td></td><td></td></tr<>	0094	IP (X. EQ. ZERO. AND. Y.LT. Z	GO TO	0			
545 60 70 500 547 548 543 50 550 FMASE (J) = 47.40 550 FMASE (J) = 57.50 500 560 FMASE (J) = 57.50 500 FMASE (J) = 57.50 511 F(1.4.17.2ER0) 60 7 520 512 FMASE (J) = FMASE (J) + 180.0 520 FMASE (J) = FMASE (J) + 180.0 530 FMASE (J) = FMASE (J) - 1, 512.1 530 FMASE (J) = FMASE (J) - 1, 512.1 530 FMASE (J) = FMASE (J) - 1, 512.1 500 CO TO 500 500 FMASE (J) = FMASE (J) - 1, 512.1 501 FMASE (J) = MASE (J) - 1, 512.1 501 FMASE STARD SOCT SOCT 1 501 FMASE (J) = MASE (J) - 1, 512.1 501 FMASE (J) = MASE (J) - 1, 151.2 501 FMASE (J) = MASE (J) - 1, 512.2 501 FMASE (J) = MASE (J) - 1, 151.2 501 FMASE (J) = MASE (J) - 1, 151.2 501 FMASE (J) =	545 60 750 547 547 50 550 FMASE (J) = 47.M (Y.X) 550 FMASE (J) = 40.M (Y.Y) 550 FMASE (J) = 10.0.0 500 500 500 FMASE (J) + 360.0 500 FMASE (J) + 360.0 500 FMASE (J) = 14.512 500 CONTINUE 500 CONTINUE <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
545 PHASE (J) =0.0 550 PHASE (J) =90.0 550 PHASE (J) =757.296*PHASE (J) FHAASE (J) =57.296*PHASE (J) FHAASE (J) =57.296*PHASE (J) FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON AND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON AND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON AND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.LT.ZERON GND.Y.LT.ZERON GO TO 530 FTC.ST.ZERON AND.Y.LT.ZERON GO TO 530 FTC.ST.ZERON AND.Y.LT.ZERON GO TO 530 FTC.ST.ZERON AND.Y.LT.ZERON GND S30 500 FALSE (J) 1486 (J) J=1,512) C RETE (J,510) (RHASE (J) J=1,512) C RETE (J,510) (RHASE (J) J=1,512) C C RETE (J,510) (RHASE (J) J=1,512) C RETE (J,510) (RHASE (J) J=1,512) C RETE (J,510) (RHASE (J) J=1,512) C C RETE (J,510) (RHASE (J) J=1,512) C RETE (J,10) (FRASE C RETE (J,10) (FRASE C RETE (J,10) (FRASE C RETE (J,10) (FRASE C RETE (J,10) (RASE (J,201) (RAF (IST), IST=1, WURBER) RETE (J,10) (FRASE ARRAY COMMON. C C RETE (J,10) (FRASE C C RETE (J,10) (FRASE C RETE (J,10) (FRASE	545 PHASE (J) = 0.0 550 PHASE (J) = 90.0 550 PHASE (J) = 51.2 550 PHASE (J) = 51.2 550 PHASE (J) = 51.2 550 PHASE (J) = PHASE (J) + 180.0 551 PHASE (J) = PHASE (J) + 180.0 550 PHASE (J) = PHASE (J) + 180.0 550 PHASE (J) = PHASE (J) + 180.0 551 PHASE (J) = PHASE (J) + 160.0 550 PHASE (J) = PHASE (J) + 160.0 500 CONTINUE 500 PHASE (J) = PHASE (J) - 1.512 500 CONTINUE 500 PHASE (J) = PHASE (J) - 1.512						And a	the state manufacture and
<pre>550 PAISE ()=97.30 mark (Y/z) 560 PAISE ()=57.30 mark (Y/z) F1X.LT.ZERO) G0 T0 530 1 F1X.LT.ZERO) G0 T0 530 1 F1X.LT.ZERO) G0 T0 530 520 PAISE ()=PHASE ()+180.0 520 PAISE ()=PHASE ()+180.0 530 CONTINUE 530 CONTINUE 530 CONTINUE 530 PAISE ()=PHASE ()+180.0 530 PAISE ()=PHASE ()+10.0 530 PAISE ()=PHASE ()+180.0 530 PAISE ()+180.0 540 PA</pre>	550 FAISE (J)=50.0 560 FAISE (J)=FN:206 THASE (J) FMALE (J)=57:206 THASE (J) FMALE (J)=57:206 THASE (J) FMALE (J)=57:206 THASE (J) FMALE (J)=57:206 THASE (J) + 180.0 520 FAISE (J)=FHASE (J) + 180.0 530 FAISE (J)=FHASE (J) + 36.0 530 FAISE (J)=FHASE (J) + 36.0 530 FAISE (J)=FHASE (J) + 36.0 500 COFFILUE 500 COFFILE 500 COFFIL							
560 FMASK (J)=57.29 6* FMASK (J) FMASK (J)=57.29 6* FMASK (J) FMASK (J)=57.29 6* FMASK (J) FT (X.1.7.ZERO) GO TC 530 00 TO 500 520 FMASK (J)=HASK (J)+180.0 530 FMASK (J)=HASK (J),J=1,512) 540 FMASK (J)=HASK (J),J=1,512) 540 FMASK (J)=HASK (J),J=1,512) 540 FMASK (J)=HASK (J),J=1,512) 540 FMASK (J)=HASK (J)=1,512) 540 FMASK (J)=HA 540 FMASK (J)=J 540 FMASK (J)=HA 540 FMASK (J)=J 540 FMASK (J)=HA 540 FWASK (J)=J 540 FWASK (J)=HA 540 FWASK (J)=HA 5	560 FMASK (J)=57.29 6* FMASK (J) FMASK (J)=57.29 6* FMASK (J) FMASK (J)=57.29 6* FMASK (J) FT (X.:LT.ZERO) GO TC 520 OC TO 500 S20 FMASK (J) FMASK (J) +180.0 530 GO TC 500 S20 FMASK (J) FMASK (J) +180.0 530 FMASK (J) FMASK (J) +180.0 530 GO TO 500 S0 TO 500 S0 TO 500 S0 TO 500 S00 CONTINUS C WATER (J, 510) (AMF (J) ,J=1,512) C WATER (J, 510) (AMF (J) ,J=1,512) C WATER (J, 510) (AMF (J) ,J=1,512) C WATER (J, 510) (PMASE (J) ,J=1,512) C WATER (J, 510) (AMF (J) ,J=1,512) C WATER (J, 10) TO (J) C TARE TRE (J, 201) (AMF (IST) ,IST=1,WUMBER) C LIL WARW (JA F, MW, S, IFSET, IFBER) WATER (J, 10) TERR TE (IWAL S, CO (J) WATER (J, 201) (AMF (IST) ,IST=1,WUMBER) C TRE PROPER FORM FOR A THARE ARRAY COMMON. C TRE PROPER FORM FOR A THARE A TRE A							
500 FMLSE (J) = 51.25 (J.) FR(X.LT.ZERO) GO TO 530 FR(X.LT.ZERO) GO TO 530 FR(X.LT.ZERO) GO TO 530 60 TO 500 520 FMLSE (J) = PHLSE (J) + 180.0 60 TO 500 530 FMLSE (J) = PHLSE (J) + 180.0 60 TO 500 530 FMLSE (J) = PHLSE (J) + 160.0 60 TO 500 530 FMLSE (J) = PHLSE (J) + 160.0 60 TO 500 500 COUTNUE C WRTE (J, 610) (PHLASE (J) , J=1, 512) C WRTE (J, 610) (PHLASE (J) , J=1, 512) C WRTE (J, 610) (PHLASE (J) , J=1, 512) C WRTE (J, 610) (PHLASE (J) , J=1, 512) C WRTE (J, 610) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C WRTE (J, 201) (PHLASE (J) , J=1, 512) C TAKE THE INVEST FRANSPORM-	700 FMARS (1) = 1.4 Miles 700 FMARS (1) = 1.4 Miles 1 F(X.17.28R0) GD T (2.57.80) GD T (2.57.880) GD T (2.57.80) 520 FMAS (1) = FMAS (1) + 180.0 500 500 530 FMAS (1) = FMAS (1) + 180.0 500 500 500 T (2.50 FMAS (1) + 180.0 500 500 500 FMAS (1) = FMAS (1) + 180.0 500 500 500 T (2.50 FMAS (1) + 180.0 500 500 500 C T (2.50 FMAS (1) + 180.0 500 (2.50 FMAS (1) + 130.0 500 C OF 1802 500 (2.50 FMAS (1) + 130.0 500 C OF 1802 500 (2.50 FMAS (1) + 130.0 500 C OF 1802 500 (2.50 FMAS (1) + 152.1 500 C OF 1802 1 MAF (1.51), 1.57 + 1.90 MBER) 500 C OF 1802 1 MAF (1.51), 1.57 + 1.90 MBER) 500 C OF 1802 1 MAF (1.51), 1.57 + 1.90 MBER) 500 C OF 1802 1 MAF (1.51), 1.57 + 1.90 MBER) 500 C OF 1802 1 MAF (1.51), 1.57 + 1.90 MBER) 501 PMAR (1.52) (MAF (1.57), 1.57 + 1.90 MBER) 1 MAF (1.51), 1.57 + 1.90 MBER) 501 PMAR (1.51), 1 FERR 1 MAF (1.57), 1.57 + 1.90 MBER) 501 PMAR (1.51), 1 MAF (1.57), 1.57 + 1.90 MBER) 1 MAF (1.51), 1.57 + 1.90 MBER) 511 MAF (1.51), 1 MAF (1.57), 1 ST + 1.90 MBER) 1 MAF (1.51), 1 MAF (1.57), 1 ST + 1.14 MBER) 511 MAF		GO TO 500					
IF(X.LT.ZER0. GO TO 530 F(X.CT.ZER0. MN.Y.LT.ZER0) GO TO 530 520 FMASE (J) = PHASE (J) + 180.0 530 FMASE (J) = PHASE (J) + 180.0 530 FMASE (J) = PHASE (J) + 150.0 500 CONTINUE 510 FMASE (J) - 1512) 511 FERS 512 CONTINUE 512 CONTINUE 513 CONTINUE 514 FMARULES 517 FMARULES 518 CONTINUE 5117 FERS 5117 FERS 5218 FMARULES 5219 FMARULES 5211 FERS 5217 FILERES 5218 FERS 5219 FMARULES 5219 FMARULES 5211 FERS 5211 FMARULES 5211 FILE 5211 FILE 5211 FILE 5211	IF(X.LT.ZER0. GO TO 520 F(X.CT.ZER0. MN.Y.LT.ZERO) GO TO 530 520 FMASE (J)=PHASE (J)+180.0 530 FMASE (J)=PHASE (J)+180.0 530 FMASE (J)=PHASE (J)+180.0 530 FMASE (J)=PHASE (J)+180.0 530 FMASE (J)=PHASE (J)+180.0 500 COT 18100 500 COT 18100 500 CONTUBUE 510 PMAST (10F10.3) 511 C WRITE (J, 510) 512 PMASE (J)-11, 512) 513 PMAST (J0F10.3) 514 PMATT (J0F10.3) 517 C WRITE (J, 501) 517 PMASES TRAMSPORM- 7 TAKT THE INVERSES TRAMSPORM- 7 TAKT PLATA BAKN TONON WE HALT THE ALLININ		PHASE (J) =57.25	(1				
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C NOTE: HERE AS IN C THE LOWER HALF OF C THE LOWER HALF OF C THE LOWER HALF OF L = U HBBBR / 2 L = L + 1 / 1 L = U HBBBR / 2 L = L + 1 / 1 L = CNL A 250 SIGNAL (ILD) = CM 250 SIGNAL (ILD) = CM 250 SIGNAL (ILD) = CM 250 SIGNAL (ILD) = CM 250 SIGNAL (ILD) = CM 17 FORTER 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1	0028		0 =						
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$ \begin{array}{c} L = NUMBBR / 2 \\ LL = L + 1 \\ D0 250 II = 1, \\ IIB = L - IIB + 2 \\ IIC = IIB + 2 \\ IIC = IIB + 2 \\ IIC = IIC - 1 \\ G = REAL(SIGNA \\ G $			HALF OF	THE ARRAY UPWARD IN	STEAD OF DOWNWARD.	nout dat			
D0 250 IIA = 1, IIB = L - IIA + IIC = IIB * 2 IID = ILC - 1 6 = REAL(SIGNAL H = AIHAG(SIGNAL H = AIHAG(SIGNAL C SIGNAL(IIC) = C 250 SIGNAL(IIC) = C 250 SIGNAL(IIC) = C IF(IWRI2.EQ.1) C TAKE THE FOURTER IF(IWRI2.EQ.1) C TAKE THE FOURTER 17 FOURTER 17 FOURTER 17 FOURTER 17 FOURTER 17 FOURTER 18 FOURTER 17 FOURTER 18 FOURTER 18 FOURTER 19 FOURTER 10 FOURTER 10 FOURTER 10 FOURTER 10 FOURTER 10 FOURTER 10 FOURTER 11 FOURTER 11 FOURTER 12 FOURTER 12 FOURTER 12 FOURTER 13 FOURTER 14 FOURTER 15 FOURTER 16 FOURTER 17 FOURTER 18 FOURT	0029		BR /				and the second se		
<pre>IIB = L - IIA + IIC = IIB + 2 IIC = IIB + 2 IIC = IIB + 2 IIC = IIC - 1 G = REAL(CIC) = C SIGMAL(LIC) = C 250 SIGMAL(LIC)</pre>	0030		.1 .						
IIC = IIB * 2 III = IIC - 1 G = REAL(SIGNAL H = AIMG(SIGNAL G = REAL(IID) = C 250 SIGMAL(IID) = C 250 SIGMAL(IID) = C 250 SIGMAL(IID) = C 17 [IWRI2.EQ.1] C IIF(IWRI2.EQ.1] C IIF(IWRI2.EQ.1] C IIF(IWRI3.EQ.1] 17 PORMAT(1.21) IF2 17 POL C**** READ(1.234) POL	0032		+ VII - 1 =						
<pre>LID = LLC = LLC = LLC = LLC = LLC = C</pre>	0033		= IIB *						
H = A IMAG (SIGNA H = A IMAG (SIGNA SIGNAL(ILD) = C 250 SIGHAL(ILD) = C IF(14812.EQ.1) C IF(14122.EQ.1) C TAKE THE POUBLER CALL HARM(SIGNA CALL HARM(SIGNA A RITE(3,17) IF2 17 FORMAT(" IF IF(14813.EQ.1) C **** READ(1,234) POL	0034	,	REAL (SIGNAL	((31					
250 SIGNAL(ILC) = C 1 [[1812.EQ.1] C TAKE THE FOURLER TREET HE FOURLER CALL HARM(SIGMA RAILE 1, 1, 1 17 FORMAT(17 [1813.EQ.1] C**** READ(1,234) POL	0036		TGNA	VIC 0 01					
IF(IMEI2.EQ.1) IF(IMEI2.EQ.1) C TAKE THER0ELER IFSET = 1 CALL HARM(SIGMA CALL HARM(SIGMA RATE(3,17) IFE 17 FORMAT(1 IF) IFE IF(IMEI3.EQ.1) C**** READ(1,234) POL	0038	250	SIGNAL (IIC) = C	LX (H, 0.0)					
C TAKE THE FOURLER TAKE THE FOURLER TEST = 1 CALL HARM(SIGWA RAILE 3,17) ITE 17 PORMAT(TF(IWRI3.EQ.1) C**** READ(1,234) POL	0039			ITE (3, 222)	CONTROL AND DO				
IFSET = 1 CALL HARM(SIGMA CALL HARM(SIGMA RRIE (3,17) IF 17 FORMAT("IF IF(IMR13.EQ.1) C**** READ(1,234) POL	0 1 0 0		<u>22</u>	LTE (3, 201) (SIGNAL (1. RANSFORM	Total , Lore 1, NURBER				
CALL HARM(SIGMA CALL HARM(SIGMA REREAT(IF(IWRI3.EQ.1) C**** READ(1,234) POL	0041								
17 FORMAT(" IF IF(IERI3.EQ.1) IF(IERI3.EQ.1) C**** READ(1,234) POL	0042		CALL HARM (SIGNAL, H	M, INV, S, IFSBT, IFERK					
IF (IHRI3-EQ.1) IF (IHRI3-EQ.1) C**** READ(1,234) POL	0044	17	II ()						
C**** IF(IMRI3.EQ.1) C**** READ(1,234) POL	0045		- EQ. 1)	ITE (3, 223)					
47 READ (1,234) POI	9 10 0	****		ITE (3, 201) (SIGNAL (1.	TST			•	
	0047		POI	EV, PO					

00000 31 WARK 17310_31 00001 33 WARK 17510_31 00001 33 WARK 17510_10 00001 33 WARK 17510_10 00001 WARK 17510_10 WARK 17510_10		TRART 21	FLTRA	DATE = 73332	E2/1E/00	PAGE 0002	
235 PURRA (\$,235) DE 235 PURAT (\$ 287LAT C **** " " 1 1.5 ACCO C **** " " 1 1.5 ACCO C **** " " 1 1.5 ACCO RHE 1 1.0 - DEV *FO NHE 1 = 1.0, (P ERV) *FO (0, 1) = AMAG * COS (0, 1) = AMAG *							
C = 1 - 1 - 5 ACCO NL= (1 - 0-DEW) *FO NH= (1 - 0-DEW) *FO C = 20 - 0 - 1 - MH NHO 40 - 0 - 1 - MH ARAG=0.0 - 1 - MH (0 - 0 - 0 - 1 - MH ARAG=0.0 - 1 - MH (0 - 0 - 0 - 1 - MH ARAG=0.0 - 1 - MH (0 - 0 - 0 - 1 - MH ARAG=0.0 - 2 - 1 - MHAL C = 240 FOHAT (1 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 -			N ROUALS . F10.3)				
C = 11 1.5 ACCC C = 11 1.5 ACCC HH= (1.0+DEV)*FO HH= (1.0+DEV)*FO C = 1.0 HH= (1.0+DEV)*FO C = 1.0 HF= HH= HH= HHAL HH= HHAL HHAL HHAL		1.00	(Madoun				
NL= (1.0-DEV)*FC NH= (1.0-DEV)*FC NH= (1.0+DEV)*FC HP1= HH+1 N= (1.0-DEV)*FC HP1= HH+1 N= (1.0-DEV)*FC N= (1.0-DEV)*PC N= (1.0-DEV)*2 N= (1.0	υ υ	wim IN 1.5	-	G DC			
NH= [1.04DEW)*PO RLPT= HL+1 NHFT= HL+1 NHG=0.0 AMAG=0.1 AMAG=0.1 AMAG=1.0 Cold= AMAG=CI0 Quotyle Quotyle AMAG=0.0 AMAG=0.0 AMAG=1.0 AMAG=1.0 AMAG=1.0 Qa(J) = AMAG=CIN Qa(J) = AMAG=COS Qa(J) = AMAG=COS Qa(J) = AMAG=COS Qa(J) = AMAG=COS Qa(J) = AMAG=0.0 AMAG Q			ELP+1.5				
C+*** NHALF=NUHBER/2 NHALF=NUHBER/2 NHALF=NUHBER/2 DO 400 J=1,ML AAAG=0.00/4.0) AAAG=0.00/4.0) AAAG=0.0 Co(J) = AAAG=COS(S(J) = AAAG=COS(S(J) = AAAG=COS(S(J) = AAAG=COS(S(J) = AAAG=COS(J) = COAAAAG=COS(J) = COAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	0053	NH= (1 . 0+DEV) *PO/D	ELF+1.5				
BW= (MH-WL) /2 C**** WHALF=WUBER/2 D0 400 J=FMAG=0.0 AMAG=0.0 J=AMAG=0.0 AMAG=0.0 J=AMAG=0.0 C0 400 J=AMAG=0.0 C0 (J) =AMAG=0.0 C0 410 J=AMAG=0.0 AMAG=0.0 C0 410 J=AMAG=0.0 AMAG=0.0 AMAG=1.0 AMAG=0.0 AMAG=1.0 AMAG=0.0 AMAG=0.0 AMAG=0.0 C AMAG=0.0 AMAG=0.0 AMAG=0.0 C <td>0055</td> <td>N HP 1 = N H+1</td> <td></td> <td></td> <td></td> <td></td> <td></td>	0055	N HP 1 = N H+1					
C**** NHALF = NURBER/2 D0 400 J= MAG=0.0 AAG=0.0 AAG=0.0 C0 J = AAAG=0.0 C0 J = AAAG=0.0 C0 J = AAAG=0.0 C0 J = AAAG=0.0 QA (J) = AAAG=0.0 AAAG AAAG=0.0 AAAG AAAG <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
D0 400 J=1,ML MAG=0.0 1=MAG=0.0 C0(J) = MAG=0.0 C0(J) = MAG=0.0 C0(J) = MAG=0.0 C0(J) = MAG=0.0 AAAG=1.0 AAAAG=1.0 AAAAAG=1.0 AAAAAG=1.0 AAAAAAG=1.0 AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA							
AMAG=0.0 AMAG=0.0 AMAG=0.0 CO(J) = AMAG=CASCIS QOUTBT (J) = AMAG=SCIS QOUTBT (J) = CAPLF QOUTBT (J) = AMAG=SCIS QOUTTT (J) = CAPLF 400 CONTTA (J) = AMAG=SCIS QOUTTT (J) = AMAG=SCIS QOUTTT (J) = CAPLF AMAG=1.0 AMAG=0.0 C AMAG=0.0 AMAG=0.0 AMAG=0.0 AMAG=0.0 AMAG=0.0 AMAG=0.0 AMAG=0.0 C AMAG=0.0 C AMAG=0.0 C AMAG=0.0 C AMAG=0.0 C <td>8500</td> <td>DO HOO I-1 MI</td> <td></td> <td></td> <td></td> <td></td> <td></td>	8500	DO HOO I-1 MI					
AFAZE = (POL/4.0) CO(J) = AMAGeCOS QA(J) = AMAGeSCIN QUOTET (J) = CAPLT, M AMAG=1.0 DO 410 J= MLP1, M AMAG=1.0 CO(J) = AMAGeSCIN QA(J) = AMAGeSCIN QA(J) = AMAGeSCIN QA(J) = AMAGeSCIN QA(J) = AMAGeSCIN QA(J) = AMAGeSCIN QA(J) = AMAGeSCIN QAAGE = (POL/4.0) AAAZE = (POL/4.0) AAAAZE = (POL/4.0) AAAAZE =	0059						
CO(J) =AMAGeSIN QA(J) =AMAGeSIN QUOTHIUE DO 410 J=RHP1,N ARAG=T.0 DO 410 J=RMP1,N ARAG=T.0 AFAZE=(POL/4.0) CO(J) =AMAGeCOS QA(J) =AMAGEOS QA(J) =AMAGEOS	0000	-	.14159				
400 CONTRUE 400 CONTRUE 0.0 410 J=RLP1, W AFAG=T_0 AFAG=T_0 AFAG=T_0 AFAG=COSI 0.1 =AHAGeSCN 0.1 =AHAGeSCN 0.1 =AHAG+COSI 0.1 =AHAG+COSI <t< td=""><td>0061</td><td></td><td>AZE)</td><td></td><td></td><td></td><td></td></t<>	0061		AZE)				
400 CONTINUE 00 410 J=HLP1, M ARAZE= {POL/4.0} ARAZE= {POL/4.0} ARAZE= {POL/4.0} CO(J)=AHAG4000 (QUCN=AHAG4000 (QUCN=AHAG4000 (ARAG=0.0 410 CONTINUE CONTINUE ARAG=0.0 ARAG=0	0063		(11) OA (J))				
D0 410 J=RM261.0 ARAGE=T.0 ARAGE=T.0 Co(J)=AMAGe*COS (00(J)=AMAGe*COS (00(J)=CMPI (00(J)=CMPI (00(J)=CMAL (00(J)=CMAL (00(J)=CMAL (00(J)=CMAL (00(J)=CMAL (00(J)=CMAL (00(J)=CME (00(J		CONTINUE	1101 871 101 0				
AAAGE = { 00 J = AHAGe = 2 (0 J - 4) CO(J) = AHAGe COS (QA(J) = AHAGe COS (QA(J) = AHAGe COS (QA(J) = AHAGe COS (QA(J) = AHAGe COS (AAAGE = (0 J = AHAGe COS (QA(J) = AHAGe SCI (APACE (CO(J) = AHAGE (APACE (QA(J) = SCI (APACE (CO (DO 410 J=NLP1,					
AFAZE FPAZE FPAL4.0) CO(J) = AHAG4COS QA(J) = AHAG4COS QA(J) = AHAG4COS QACJ = AHAG4COS AAAG40.0 AAAG40.0 QOUNTY(J) = CAPLX QUONTY(J) = CAPLX QA(J) = AHAG45COS QA(J) = AHAG45COS QA(J) = AHAG45COS QA(J) = AHAG45COS QUONTY(J) = CAPLX QA(J) = AHAG45COS QA(J) = SIGAAL(J) = SIGAAA QA(J) = QAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	0066						
410 420 C 4420 C 4420 C 444 425 425 C 240 C 250 C 240 C 250 C 240 C 250 C 240 C 250 C 2	0067	~	.14159* (FO/DELF+	1-J) / BH			
410 410 64445 6440 64445 6440 64445 430 64444	0069		A25)				
410 410 C C 4420 C C 4444 C C 4425 425 C 425 C 425 C 425 C C 4425 C C 4425 C C 4426 C C 64848 C C 64848 C C 64868 C C 64868 C C 64868 C C C 64868 C C C 64868 C C C 64868 C C C 64868 C C C C C C C C C C C C C C C C C C		QUOTNT (J) =CMPLX	((r) vo, (r) o				
425 C 240 C 240 C 240 C 425 C 425 C 430 C 436		CONTINUE					
425 425 425 425 425 425	2/00	= NHP1, N	LF				
425 C 240 C	0074		. 14159				
C 240 C 20 C 20 C 20 C 20 C 20 C 20 C 20 C 2	0075)					
420 C 420 C 440 C 240 C 2 C 240 C 2 C 2 C 2 C 2 C 2 C 2 C 2 C 2	0076	~	AZE)				
420 C 440 C 240 C 240 C 240 C 4844 C 430 C 4844	0078		111.04 (.11)				
ссссс (425 с30 с31 с****	t	CONTINUE					
C 240 C 240							
C**** 4.30 C****		WRITE (3,240) (0 FORMAT(11,8715-	TNT (J), J=1,512)				
425 C****	C#						
425 C****	0080	DO 425 J=1, NHALP	11 - 010-010				
430 C+++			In THINAL IN				
430 C####							
4.30 C++++							
* * 2			(SIGNAL(J))				
C + + +	0087	SIGNAL (MHP1) = CMPLX	10-0-0-01				
	0088						
	1089	TAHN . L.					
	1600	Y=01 (J)					
	092	AMP (J) =SQRT (X**241	[**2]				•
	6003	IF (X. EQ. ZERO. AND.)	V.GT.ZERO) GO TO	550			

	G LEVEL 2	21 FLTRA	DATE = 73332	00/31/53	PAGE 0003	
10094	II	IF(X.EQ.ZERO.AND.Y.EQ.ZERO) 60 TO 545	45			
0095	1P 60	(X. EQ. ZERO. AND. I.LI. ZERU) 60 10 34	2			
1600	540 PF	PHASE (J) = 270.0				
009R		G0 T0 500				
00100	09	GO TO 500				
	550 PH	PHASE (J) =90.0				
0102		GO TO 500				
	14 000	10		10 11		
0105	I	0 TO 520				
0106	II	60 T0	530			
0107		TO 500				
0108	520 PF	PHASE (J) = PHASE (J) + 100.0				
0110	530 PF	PHASE (J) = PHASE (J) + 360.0		-		
111				····· · · · · · · · · · · · · · · · ·		
	200					
01		WRITE(3,610) (AMP(J),J=1,512)				
		WRITE (3, 233) (PHASE (J) , J= 1, 512)				
0113	610					
	C****					
0114	I	P(IHRI4.80.1) WRITE (3,224)	TCRI TCM-1 MUMBPRI			
0115		TF(ITRI4.20.1) MAILE (3.2.01) (STURAL (131) +131-1, succession marks with tweeder Pointers	Intering a Later & I ter			
0116 C		TPSET = -1				
0117	U	CALL HAEM (SIGNAL, M, INV, S, IFSET, IFERE)	(R)			
0118	28	20				
0119	I	P(IURI5.80.1) WRITE (3,225)	TCTI TCT=1 NUMBERI			
		IP (INRID- EQ. 1) WAIIE (J, 201) (INRUAL)	MALTE (3,201) (STURAL (131), 131 - 1, 200 20)	BE IN THE		
		-		-		
		I IIH = 1,L				
0122	H	IIJ = $2 * IIH$				
0123	H	I = III = XI				
0124	~ 0	- REAL(STONAL(TIN))				
6710	2 1 LC	TCMAL (TTH) =				
0127	1	.1)				
0128	н	IF (IWRI6.EQ.1) WRITE (3,201) (SIGNAL (IST), IST=1,L)	(IST), IST=1,L)			
0129		RETURN				
0130	4					
						a the second sec
				~ *		

ter

81

	c					
0001	0	SUBROUTINE TRI	GGB (PERIOD, MODE, NUMBER)	(BB)		
0003	400	15.	14) ** (4020) * ##E (40	44440), A (44940), WAF (44946), SPEC (120), DURF, DURD	01	
0005	401	PORMAT (311)	CE BIDTH CORP SHOULD			
0006	403	FORMAT (" NEGAT	VE VALUE POF			
1000		I 4 8	1. THR2, THR3			
6000		READ(1,400) PH	PECOFA PECONA PEDRIL D	DAMA DWAMA		
0010		(001	PUCOPB, PUCONB, PUDELE, PPAMB, PNAMB	PAMB PAMB		
1100	****	-	READ (1, 400) ENORHI, ENORLO, XNORDE, ETRIP	RIP		
0012	****	DUCOPA=0.0				
0013		PUCOPB=0.0				
0014		PNAMA =-9.0				
0015		PNAMB=-9.0				
0016		PPAHA=9.0				
0018		PPATB=9.0				
0019		UMBER/	8			
	C++++					
0020		-	BTRIGU, ETRIGD, TRGDEL			
0021		_	PUCOFA, PUCONA, PUDELA, PPAMA, PNAMA	, PPAMA, PNAMA		
2200		_	PUCOFE, PUCONE, PUDELE, PPAME, PNAME	, PPAMB, PNAMB		
0024	1100	PORMATIC (3, 1103) P	TUS) ENGENI ENGRICATION TO TO THE PARTICLE STRIP			
	1	P7.3. V	POR INCREASING VOLTA	OA	VOLTS POP DECR	
	N	./.	DELAY IS', F15.10, ' SECONDS')			
0025	1101	AT (' DETEC	TOR SECTION . / DETI		PULSE WIDTH IS', P	
	c	TTRES T	THE FLUTTER SIGNAL PI	PLUS PLUS PLUS		
	4 100	. F 10-1 .	CT GUTE AUTOR VUTA	ANTA TAUNSTA UNA "L'. J''. AND MESTUUAL ACUN	ALUS IS'	
0026	1102	r (* DETEC	TOR SECTION . / DETI	ECTOR B'/' PULSE WIDTH	A. SI HIDIW	
	-		HE FLUTTER SIGNAL PL	THE FLUTTER SIGNAL PLUS ", P10.7, SECONDS' /*		
	24	F10.7.	PEAK PULSE VALUE IS	PEAK PULSE VALUE IS', F7.3, 'AND RESIDUAL VALUE	TOP 1	
0027	1103	T (' NOR C	1/ NOI	OUTPUT VOLTAGES'/'	HIGH	
			' .P7.3/' DELAY	·, F7. 3/1	TRANSITION VOLT	
		- 0 0000.m	10			
		MONP = 1 OPPARATE	D ON GOU AND DITUTUO ADDAV	21 0 0 1		
0028		TODE-BO-1-A	ND. PHCOPA. GT. 0. 01 GO	TO 495		
0029			ND.PHCOFB.GT.0.0) GO			
		TT TRIGGER				
		LION SC	ANS THE DATA STREAM FOR CROSSINGS		OF THE TRIGGERING	
		VOLTAGE. IF THE	VOLTAGE CROSSES ETRIGU INCREASING,	ING.	A	
		VOLTAGE CROSSES	PTDICH DECORASING THEN A VALUE	THAT POINT. LIKEWISE	TH THE	
	C	100	AM AT THAT POINT.	5		
0030						
0031		[J = 1,	II			
0032		IJ				
0033						
0034		IP (MODE.GE.1) G	GO TO 455	0 TO 455		

455 454 455 455 455 455 455 455 455 455	WD FLUTTER STREAN) I.(IJ).LT-EFRIGU.AND.SIGNAL(IL).GT.EFRIGU) GO TO 452 I.(IJ).GT.EFRIGU.AND.SIGNAL(IL).LT.EFRIGD) GO TO 454) 0.0 1.1 100.0) 100.0) 0.0 100.0 0.0) 100.0) 0.0 0.0	
452 454 455 455 455 455 455 455 455		
451 451 451 457 457 455 455 455 455		
452 454 457 457 459 459 459 459 C****		
454 457 455 455 455 455 455 455 455	• • • • • • •	
сс 455 455 455 455 455 65 455 65 455 65 455 65 455 65 65 455 65 7 65 7	· · · · · · · · · · · · · · · · · · ·	
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
C 455 457 459 459 458 C 458 C 458		
457 457 456 456 C44458 C44458	0 OL	
457 459 456 458 C####		
457 459 458 C****	100.0 0.0 0.0 0.0	
457 459 458 Ceeee	100.0 0.0 0.0 0.0	
458 C+++	0-0 0-0 0-0	
456 458 C****	0.0	
456 458 C****	0.0	
458 C####	0.0	
	0.0	
	** (INTERSENT OF LE JOY AND DUMD GT EFRIGU GO TO 552	
0057 IF (SIGNAL (NUMBER)	GO TO	
0058 SIGNAL (NUMBER)	BER) = 0 • 0	
552	ave) = 100 0	
0062 554 A (NUMBER) =100.0		
0064 GO TO 556	3EK) =0.0	
555	1	
0066 IF (NUMBER)	BEB) .LT.ETRIGU.AND.DUMF.GT.ETRIGU) GO TO 557	
	O DI ON CONTRACTOR PROFESSION ON TO TANK	
557 WAP (NUMBER)	=100.0	-
0 0072 01 05 1000 1000		
	0.0=	
0074 556 CONTINUE		
C****		
	T) CALL WRITE(BUGBER)	
Ind	A DATA IS CONTAINED ON AND IN THE THO ALLONDWITCH STAFT OF UPWARD CROSSINGS	
AND ONE FOR	NUARC.	
C DETECTORS A AND	AND В В В В В В В В В В В В В В В В В В В	
	USE IT OUTPUTS A PULSE OF SPECIFIED DURATION. IF THE	
	UT ON THE SIGNAL CHANNEL, ITS DURATION IS	
C DETERMINED BY TH C IS TO BE BUT ON	3Y THE MAGNITUDE OF THE WAF CHANNEL AT THAT TIME. IF IT P ON THE WAF CHANNEL ITS DURATION IS FIXED.	
Catat		

		TRIGGE	DATE = 73332	EG/1E/00	PAGE 0003	0	j.
	C LOGIC MODIFIED	BD TO CHANGE PULSE HEIGHT	IGHT				
2700	071 00						
0077	IN = NUMBER -	1, NUTBER					
0078	(NO	GO TO 468					
0100	C CHECK FOR INPUT	PULSES					
6100		0 6					
0081	SIGNAL (IR) = P	PHARA					
0082	468 IF (WAF (IM) .GT	r.80.0) GO TO 476					
0083		WAP(IM) = PNAMA					
0085	469 CONTINUE						
00.86	A /TMI = DWIND	00) 60 TU 480					
0087	CO TO 490						
		D PULSE VALUE					
0088	H	PNA MA					
6800	A (IM) = PNAMB						
1600	476 WAP(IM) = PNAM	HA					
0092							
6003	477	IPWID= ((PWCOFA*WAF (IM) +PWCONA) /PBRIOD) +0.5	RIOD) 40.5				
	C COMPUTE PULSE	HEIGHT FOR A DECTOR					
10091		TPH DA DDA MA 4 UA P / T M1 4 DDAMA					
	C****	AAR (TD) TEFADA			~		
	OT IN PULSES	IN DATA LINE					
0095	IDELAY= (PUDEI	1					
9600	IN = IDELAY +	NI .					
1600	L-GINdI+NI=OI						
0000	NI = GI CLU UU	N TO					
0100	IP (NODE GE 1)	GO TO 471					
	C####						
0101	SIGNAL (IP) =TEM	MPA					
	C****						
0102	GO TO 472				41		
2010	HAT COUNTURE - PPAN	RA .					
0105	CONTINUE						
0106	480 IPWID= ([PWCOPB:	B*WAF (IM) +PWCONB) /PEF	810D1+0=5				
3	C COMPUTE PULSE	HEIGHT FOR B DETECTOR	DR				
0107	TERPB=-PPAMB*W	HAP (IN) +PPAMB					
0108	A (I M) = PNAMB		*				
0109	IDELAY = (PUDELB	m					
1110	TOTINT TOTINT	11					
0112	IN OI) ON I W=OI	ABE B)					
	NO	INE (A ARRAY)		5			
0113	DO 482 IP = IN	N, IO					
0114	IF (HODE.GE.1)	GO TC 481					
0115	A (IP) =TEMPB						1
0116	GO TO 482						

0117 4		DATE = 13332	00/31/53	PAGE 0004	
	481 A (I P) = PPAMB				
*0	484 CONTINUE				
	GO TO 489				
1210	489 CONTINUE				
	THE CONTINUE				
U	NOR CIRCUIT				
	ON N	E A AND B DETECTORS			
0124	CAI				
57.0	DE				
0127	DO 492 IR = 1, NUMEER				
0128	AUAL T SI =				
0129	TPITT CT NUMBPOL CO PO HOS				
0130	IF (NODE) 492.499.497				
C####					
	499 IF (SIGNAL (IS) . GT.ETRIP.OR.A (IS) . G	r.ETRIP) GO TO 600			
0132	IF (SIGNAL (IS) . LT . FTRIP. AND. A (IS) . I	LT. PTRIP. AND. A (IS) . LT. BTRIP) SIGNAL (IT) =			
0133	T-AHIN' (SIGNAL (IT), A (IT))				
	60 TO 492				
	CO TO HOS TO HOS				
	1 GT	TOT DO TO COL			
	IF(WAF(IS) .LT.	PATEL OU TO OUI			
	1-AMIN (WAP (IT) , A (IT))	- (17) 388 (3707)			
0138	GO TO 492				
**	601 WAP(IT) =-AMAX1 (WAF(IT), A(IT))				
0140 0140	100 CONT T NILE				
	495 WRITE (3.402)				
0145	(0-02				
0146	T = 1,				
	IF (BODE) 440				
0149					
	ULS HAPTTTI = PNORLO				
0151 44	CONTINUE				
0153	IP(IWR3.EQ.1) CALL WRITE(NUMBER)				
0154					
0155	END				

LOCATION SYMBOL LOC 29C ETRIGD LOC 280 PPAMA 280 PPAMA 280 PPAMA 300 PPAMA 314 IP 314 IP 328 J 328 LO 314 IP 328 LO 328 LO 1100 LOC	LOCATION SYMBOL 29C ETRIGD 280 PPAMA 2264 PPAMA 2024 PPAMA 300 PPAMB 314 IJ 314 IP 328 J14 IP 328 J14 IP 328 J14 IP 328 J14 IP 328 J14 IP 328 J14 IP 36 II 100	LOCATION SYMBOL 29C ETRIGD 280 PPAMA 280 PPAMA 282 L 300 PPAMA 314 L 330 PPAMA 314 L 1100 100 100	LOCATION SYMBOL 29C ETRIGD 280 PPAMA 280 PPAMA 202 PPAMA 300 PPAMA 314 IP 314 IP 328 II 36F SYMBOL 100	SYMBOL PPAMA PPAMA PPAMA RTRIP PPAMA RTRIP PPAMA RTRIP PPAMA RTRID PPAMA RTP PPAMA PPAMA RTPAMA RTPAMA RTPAMA RTPAMA RTPAMA RTPAMA RTPAMA RTPAMA RTPAMA
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2C4 FPANS 2D8 FPANS 2BC LJ 300 FERIOD 314 IF 328 IFFIOD 328 IFFION 1100	ZC4 FPANS 2D6 FPANS 3D0 FPANS 314 IP 328 PPANS 314 PPANS 314 PPANS 314 PPANS 314 PPANS 328 PPANS	2C4 FFAMB 2D8 ETRIP 300 FERIO 314 IP 328 ITRIP 3314 IP 328 ITOD 328 ITOD 36F 1100	2C4 FFAMB 2D8 ETRIP 300 FERIOD 314 IP 328 ITRIP 334 IP 1100 36F 1100	2C4 FFAMS 2D8 BTRIP 300 FERIOD 314 IP 328 IT 328 IT 328 IT 1100 36F 1100
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	υU		6 4 4 d	2000 - 3104	56/16/00	PAGE 0001	
	00						
0002		SUBROUTINE DELAYP (F COMMON SIGNAL (4096) DIMENSION TEMP (500)	AYP (FERIOD, MODE, NUMBER) (4096), A(4096), WAP(4096)	80			
	00	PROGRAM SCANS APPRO	FRIATE DATA STREAM	PPROFILATE DATA STREAM AND MOVES ALL DATA POINTS AMOUNT LATED IN WITHD	POINTS		
0000	700						
9000	104	PORMAT (111)	2				
0001							
0000	с С		IN TERMS OF SAMPLE POINTS.	TS.			
6000	722	IF (MODE) 750, 721, 722 WRITE (3.1104) DELAV	22				
0010	1104	BLAY	OUTINE,	DELAYS DATA IN SIGNAL STREAM. F10.7.	·		
0011	-	TSECONDS ')			•		
0012	721	WRITE (3, 1105) D	Y				
0013	1105	FORMAT (" DELAY	SUBROUTINE DELAYS DATA	IN WAP STREAM	", F10.7, * SECO		
0014	723	CONTINUE					
0015		LAY /	PERICD) +0.5				
0100	C	PILL UNSHIPTED DATA	DATA WITH CVCI IC ADDAV				
0017			TO 726	-			
0019		UO 725 IV=1, IV					
0020		IF (MODE) 753,730,729	6				
0022	129	GO TO 725					
0023		TEMP(IV) = WAP(IY)					
0024	725	CONTINUE					
2		DELAY REST OF ARRAY					
0026		0 IV = 1,					
0028		I + I = I = I = I					
0029		3.7					
0031		SIGNAL(IX) = SIGNALGO TO 750	(11)				
0032	752	WAP(IX) = WAP(IW)					
0034		GU TU /5U					
0035		HODE	VALUE IS NEGATIVE')				
00 36	150						
0037	5	IF(IVV-E0-0) GO TO	FRONT OF ARRAY 761				
8600							
00400	I C9L	IF (MODE) 753, 764, 762 STGNAL (T) = TPMD (T)					
1 100							
0042	764 1	WAF(I)=TEMP(I)					
0044	761 0	CONTINUE					

045	G LEVEL 21 IF(IWR1.E0.1) CAL	DELAYP Call Write(NUMHER)	DATE = 73332	00/31/53	PAGE 0002	
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PAGE 0003	LOCATION	LOCATION	LOCATION 148 15C	LOCATION	LOCATION 9C1				
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00/31/53	LOCATION	LOCATION	LOCATION 144 158	LOCATION	LOCATION 984				
U	STHBOL	STHBOL	I V V I Y V I Y	STHBOL	STRBOL 1105				
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	/ MAP SYMBOL WAP	SYMBOL	SYMBOL NODE IV	SIMBOL	MAP SYMBOL 1104	ST, DECK, LOAD, MA CNT = 58 47, PROGRAM SIZE			
DELAYP	COMMON BLOCK / LOCATION 4000	SUBPROGRAMS CALLED LOCATION 130	SCALAR MAP LOCATION 13C 150	ARRAY MAF Location	FORMAT STATEMENT LOCATION 93D	TINIT			
21	CC STHBOL A	STHBOL STHBOL WRITE	SC STNBOL DELAT NUMBER I	AR SYMBOL	FO 401	FECT* ID, BECDIC, SOURCE, FECT* NAME = DELAYP , SOURCE STATEMENTS = , NO DIAGNOSTICS GENERATED			
IV G LEVEL	LOCATION 0	LOCATION 12C	LOCATION 138 14C 160	LOCATION 168	LOCATION 938	*OPTIONS IN RFFECT* *OPTICNS IN RFFECT* *STATISTICS* SOUBC *STATISTICS* NO DIAG			
FORTRAN	STABOL SIGNAL	SYMBOL IBCOM#	SYMBOL THR1 IU IX	Tenp Tenp	SYMBOL 700	* OPTIC * OPTIC * STATI * STATI			

001 C FORMATING AND FORMATING OF THE APPROPRIATE DATA C FORMATING ON ALLORS ALL ONDO, LANDER 0000 0000 000 1000 VLUE IS REAFTYET) 0000 000 000 000 000 000 000 000 000 0		LEVEL	21 - AMPL	DATE = 73332	00/31/53	PAGE 0001	
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1001 MATERIATER SUBROUTINE, FROVIDES GAIN OF ',FOR SIGN 1106 MATERIA 1107 PORAT ('ARELITER SUBROUTINE, FROVIDES GAIN OF ',F10.2,'FOR WAP 1107 PORAT ('ARELITER SUBBOUTINE, FROVIDES GAIN OF ',F10.2,'FOR WAP 1107 PORAT ('ARELITER SUBOUTINE, FROVIDES G	0007		(TAD (1,601) GAIN				
1100 POEMAT() ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 11_LDATN) 622 WERE(3)107) GAIN 11.DATN) 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 106 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 107 POEMET(1 ANFLIFIER SUBBOUTINE, PEOVIDES GAIN OF ', F10.2, FPOR SIGN 106 POES SIGNAL (1 U) = GAIN + NAP (1 U) 555 CONTINUE 570 POES SIGNAL (1 U) = GAIN + NAP (1 U) 570 POES SIGNAL (1 U) = GAIN + NAP (1 U) 570 POE SIGNAL (1 U) = GAIN + NAP (1 U) 570 POES SIGNAL (1 U) = GAIN + NAP (1 U) 570 POE SIGNAL (1 U) = GAIN + NAP (1 U) 5		621 1	RITE (3, 1106) GAIN				
62 00 10 10) 62 WATE (3,1107) GAIN 1617 FORM THE RUBBOUTINE, PROVIDES GAIN OF ', P10.2, POR WAP 1617 FORM (10) 631 00 1, 100 0, 100		1106	AMPLIFIER				
107 FORMAT (1 AMPLIFIE SUBBOUTINE, PROVIDES GAIN OF ',F10.2,'FOR WAY 1.107 FORT NUE (107 FORT NUE (107 FORT NUE (107 FORT NUE (108 FORT NUE (108 FORT NUE (109 FORT NUE (109 FORT NUE (100 FORT	0011		. UATA') 50 TO 623				
1107 FORMAT (1 ARPLIFIER SUBROUTINE, EROVIDES GAIM OF ',F10.2, FPOR WAR 14007 623 CONTINUE 623 CONTINUE 17 (005) 651 51, 652, 653 651 TF (005) 655 652 STGMAL (10) = GAIM * SIGNAL (TU) 653 MAP (LU) = GAIM * MAP (LU) 653 MAP (LU) = GAIM * MAP (LU) 17 (18 MAP (LU) = GAIM * MAP (LU) 880 880	0012		1107) GAIN				
623 CONTINUE 1 TF(MORE) 655 IU = 1, 651 WRTT2 (3,60) 652 SIGNAL (IU) = 6 653 MAF (IU) = 6 653 MAF (IU) = 6AIN 655 CONTINUE 887URW 887URW		107	AT (" AMPLIFIER SUBROUTINE,	BS GAIN OF ", F10.2			
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651 WITTE (3,600) 652 TO 655 652 MAF (1U) = 6 653 MAF (1U) = 6 655 CWITHUE 655 CWITHUE 887URW + 20.1) 887URW + 20.1)	0016		51.6				
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ESS CANTING ESS CANTING ERFURM END END END	0020		55				
	1700		ATR +				
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0001	SUBROUTINE LI	MIT (PERIOD, MODE, NUMBER)				
	FORMAT (4 F10.		()			
0004	301 FORMAT (" N 401 PORMAT (111)	NEGATIVE VALUE FOR HODE	(.			
	READ (1,401)]	R1				
0008	READ (1,300) GA WRITE (3,1107)	GAIN1, GAIN2, DELAY, ECLIP) GAIN1,GAIN2,ECLIP,DELAY	LIP			
	1107 FORMAT (SUBRO	DTINE LIMIT'/'	MODELS LIMITER WITH GAIN OF " F7.3	0P ', P7. 3,		
	25 . P7.3 . VOL	LTS'/ DELAY IS PID BY	CLIPPING VALUE IS PI	US OR MIND		
υ	GAIN 1GAIN BE	EFORE THE CLIPPING STAGE	GE			
0010	GAIN2GAIN AF	GAIN2GAIN AFTER THE CLIPPING STAGE				
C	COMPUTE AVERAGE	E SIGNAL LEVEL				
0011	IF (MODE.GT.0)	0				
0012	350 TOTAL = STCHAL	, NUMBER				
	GO TO 35	1441				
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	352 TOTAL = WAP(IA)	A) + TOTAL				
		/ NUMBER				
0020	IDELAY = (DELAY					
0021	8	/ GAIN1				
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Ū	ECLIP AND THEN	AMPLIFY IT.	S COT I TY DO COT A	CONT		
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0025	IC=NUMBER-IB+1	275 172				
	1.3					
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0028		- MEAN				
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0033	RSIG = ESIG *	GAI				
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0042	CO TO RAL (1U) = E	516				
	63					
0046		0 GO TO 390				
0047	NT 3HL LOC ONSZ	LITIAL PART OF THE DATA STREAM WHICH WAS DELAYED	STREAM WHICH WAS DEL	AYED		
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0048	FORTRAN IV G LEVEL 21	LINIT	DATE = 73332	00/31/53	PAGE 0002	
	DO 370 IB =	1, IDELAY				
0050	IF (HODE. GE. 1) SIGNAL (IE) = GO TO 370	0.0 TO 369				
0052 0053 0054	369 WAF (IE) = 0.(370 CONTINUE 390 CONTINUE					
0055 0056 0057	IF (IMR1. BU. 1) RETURN BBD	CALL WRITE (NUMBER)				
					-	

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	17 TEAST & AT NEWS LCS	- FRITE	DATE = 73332	00/31/53	PAGE 0001		
0001 0002 0003	COMMON SIGNAL(19 PORMAT(1)	.(4096), A (4096), WAP (4096)	()				
005	21 FORMAT (5H A 21 FORMAT (5H A 22 FORMAT (5H WAF WRITF (3, 19)	, 10110-5) , 10110-5)					
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012	RETURN END						
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	4000	WAP	8000				
LO	SUBPROGRAMS CALLED LOCATION	ZABOL	LOCATION	108HAS	LOCATION	SYMBOL	LOCATION
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	EO					•	
FORMAT	LOCATION SYMBOL LOCATION SYMBOL E9 21		LOCATION C7	SYMBOL 22	LOCATION	SYMBOL	LOCATION
c, 50	SOURCE, MOLIST, DECK, LOAD, MAP	DECK, LOAD,	AAP				
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C THE SUBROUTINE PLT C THE SUBROUTINE PLA C THE SUBROUTINE PLA C THE SESULT BE ADDAIN C COMPLEX WAF, XN C COMPLEX WAF, XN DISENSION A(3) DISENSION A(3) DISENSION A(3) DISENSION A(3) DISENSION A(51) DITENSION A(3) 220 FORMAT(1, ADTA) DATA 221 FORMAT(1 ADATA) DATA 223 FORMAT(1 ADATA) DATA 233 FORMAT(1 ADATA) DATA 234 FORMAT(2 ADATA) DATA 235 FORMA	HBER, NNUMA, N E WOW AND FL UENCY DOMAIN UELTICH WHICH HE CHANNEL I: HE CHANNEL I: HE CHANNEL I: HE CHANNEL I: S (MNUMB), COPP OTHT F CHANNEL I: CHANNEL I: S (MNUMB), COPP F CHANNEL I: CHANNEL I: S (MNUMB), COPP F CHANNEL I: S (MNU	UTEL INV, S) OTTEN DATA CHANNEL FRO IT THEN HULTERS I THEN A ULTPLERS I THEUT A ULTPLERS CONVERTED BACK TO TH (10), COPD (10) (10), COPD (10) IN PROPERLY') IN PROPERLY') IN PROPER CELLS OF AR IN PROPER CELLS OF AR	R R R R R R T R R T R R T R R T R T R T	
C THIS SUBROTATHE C THIS SUBROTATHE C THE RESULT BY A C COMPLEX WAF, XN DIEBNSION A(3) DIEBNSION A(3) DIESOU A(3) DIESOU A(3) DIESOU A(3) DIESOU A(3) DIESOU A(3) DIESOU A(3) DIESOU A	S THE WOW AND FLUT REQUENCT DOBLM. B FUNCTION WHICH I B FUOTION WHICH I F (4096) M, QUOTAT M, QUOTAT M, DIAL CHANNI- I, CHANNI- MB), S (MNUMB), SOPM M, CHANNI- MB), S (MNUMB), SOPM M, CHANNI- MB), S (MNUMB), SOPM M, S (2000 M, S (2000), S (2000), S (2000) M, S (2000), S (2000	TER DATA CHANNEL IT THEN HULTEEL S IMPUT AS A QUOT CONVERTED BACK TO CONVERTED BACK TO FOR (10) (10), COFD (10) (10), COFD (10) FROPER CELLS OF PROPER FUNCTION') H'' REAL ARAAYS') ABAL ARAAYS') , TEL6		
$\begin{array}{c} \label{eq:control} \label$	REQUENCY DOMAIN. R FUNCTION WHICH I BH TUNCTION WHICH I (4096) R,000TWT H,000TWT H,000TWT H,010TWT R,010TWT H,010TWT R,010TWT	IT THEN HULTELL SIMPUT AS A QUOT CONVERTED BACK TO CONVERTED BACK TO CONVERTED BACK TO IO, COPD (10) 10), COPD (10) FROPER CELLS OF PROPER FUNCTION') 1 PROPER FUNCTION') 1 PRAL ARAAYS') 1 PRAL ARAAYS') 1 PROPER FUNCTION')		
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$\begin{array}{cccc} & \begin{array}{c} & \end{array} \\ & \bigg \\ \\ \\ & \bigg \\ \\ & \bigg \\ \\ \\ & \bigg \\ \\ & \bigg \\ \\ \\ \\$	F(4096) H,QUOTHT H,QUOTHT H,QUOTHT H,QUOTHT H,COTHT F, MBHRANGED BEEN REARRNGED BEEN REARRNGED LTLPLICATION VEESE TRANSFORMATIO VEESE TRANSFORMATIO PACKING TO OBTAIN PACKING TO OBTAIN	10), COPD (10) PROPERLY') PROPER CELLS OF PROPER CELLS OF PROPER CELLS OF REAL ARAAYS') REAL ARAAYS')	ARRAY	
CORPLEX WAF, XW CORPLEX WAF, XW DIMENSION MOT DIMENSION MOT 200 FORMAT (* 11) 201 FORMAT (* 11) 201 FORMAT (* 11) 201 FORMAT (* 11) 202 FORMAT (* 10) 203 F	H,QUOTHT H,QUOTHT B,S(HNUHB),COFM(TINE FOR WAF CHANNI DATA IS REMERANGED BEEM REARRANGED IN TANSFORM) BEEM REARRANGED IN TANSFORM') LTTPLICATION BY TH VEESE TEANSFORM') LTTPLICATION BY TH VEESE TEANSFORM') PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2 2 TWEI3, JURIU, JUBIE5	10), COFD (10) 21') FROPERLY') FROPER CELLS OF FROPER FUNCTION') "N') REAL ARAAYS') , I BRIG	ARRAT	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	MB), S(MNUMB), COPN(TINE FOR WAF CHANNI DATA IS REARANGED DATA IS REARANGED IN TRANSFORM') TRANSFORM') UTTPLICATION BY TRA VERSE TRANSFORMATIC PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2 1 VRI3, JURI4, JUBI5	10), COPD (10) 21') PROPERLY') PROPER CELLS OF PROPER CELLS OF PROPER PUNCTION') H') REAL ARAAYS') , THELG	ARRAT	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	TIME FOR WAF CHANNI DATA IS REARANGED BEEN REARANGED I TRANSFORM) TRANSFORM) LTIPLICATION BY TRANSFORMATIC VERSE TRANSFORMATIC PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2 2 1 V RI3 JURI4, JUBI5	PROPERLY') PROPERLY') PROPER CELLS OF NSFBE FUNCTION') REAL ARAAYS') REAL ARAAYS') , REAL ARAAYS')	ARRAT	
201 FORMAT($ X_{1}$, 10F1 201 FORMAT(" FILTE 201 FORMAT(" DATA 2021 FORMAT(" DATA 2023 FORMAT(" DATA 2024 FORMAT(" DATA 2024 FORMAT(" DATA 2025 FORMAT(" DATA 2026 FORMAT(" DATA 2026 FORMAT(" DATA 2027 FORMAT(" DATA 2027 FORMAT(" DATA 2028 FORMAT(" DATA 2029 FORMAT(" DATA 2020 THE 10 (1) = NUUNA 0 (1) = NUUNA 0 (1) = NUNA 0 (2) = 0 0 (3) = 0 0 (3) = 0 0 (3) = 0 0 (1) = NUNA 0 (2) SAME SAME SAME ARAA C ANA TEAPT HAS B 12 (LU ERL DATA) 0 (1) = L + 1 12 (10 250 LIA = 1, 12	TIME FOR WAP CHANNI BERN ESARRANGED BERN EBARANGED IN FRANSFORM') LTTPLICATUN BY TRA VEREE TRANSFORMATIC VEREE TRANSFORMATIC PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2, I'WRI3, JURIU, LWAIS	L') PROPERLY') I PROPER CELLS OF I PROPER FUNCTION') N') REAL ARAAYS') , REAL ARAAYS') , REAL	ARRAT	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	TIME FOR WAF CHANNI DAT IS REMEMBANGED BEEN REARMANGED IN TRANSFORM') TRANSFORM') TRANSFORM') LUTPLICATION BY TKA LUTPLICATION BY TKA LUTPLICATION BY TKA FACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2 LIMRI3, LUMRI4, LWAIS	PROPERLY') PROPER CELLS OF I PROPER CELLS OF (NSFER FUNCTION') N') I REAL ARAAYS') , REAL ARAAYS') , REAL ARAAYS')	ARRAT	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	DATA IS REARRANGED IN TRANSFORM') URIER TRANSFORM') URIER TRANSFORM') URIER TRANSFORMATIC VERSE TRANSFORMATIC VERSE TRANSFORMATIC PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 PACKING TO OBTAIN 3 2 (1 TRI3, I WRIU, I WAIT 2)	PROPERLY") PROPER CELLS OF NSFBR FUNCTION") N") REAL ARAYS") , IBRL6	ARRAY	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	BEEN REARANGED IN TEAMSPORN') URTEN TRANSPORN') LTIPLICATION BY TRA VEESE TRANSFORMATIC VEESE TRANSFORMATIC VEESE TRANSFORMATIC VEESE TANSFORMATIC VEESE TANSFORMATIC VEESE TANSFORMATIC VEESE TRANSFORMATIC VEESE TRANSFORMATIC	I PROPER CELLS OF NSFBR FUNCTION') NN') RBAL ARAAYS') , I BRL ARAAYS') , I BRL	ARRAY	
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224 FORMAT(* DATA 225 FORMAT(* DATA 226 FORMAT(* DATA 226 FORMAT(* DATA 231 FORMAT(* 213) 231 FORMAT(14, 521) 233 FORMAT(14, 521) 234 FORMAT(14, 521) 235 FORMAT(14, 521) 237 FORMAT(14, 521	LTIPLICATION BY TRA VEESE TRANSFORMATIC VEESE TRANSFORMATIC PACKING TO OBTAIN PACKING TO OBTAIN	NSFBR FUNCTION') N') REAL ARAYS') , REAL ARAYS')		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	VEISE TRANSFORMATIC PACKING TO OBTAIN 3 PICKING TO OBTAIN 3 2 TWRI3, IWRI4, IWBI5	H') REAL ARAYS') , REAL ARAYS')		
230 PORMAT(213) 231 PORMAT(213) 231 PORMAT(14, 571(232 PORMAT(14, 571(233 PORMAT(14, 571(14, 571(234 PORMAT(14, 571(235 PORMAT(14, 571(235 PORMAT(14, 571(236 PORMAT(14, 571(237 PORMAT(14, 571(237 PORMAT(14, 571(233 PORMAT(14, 571(234 PO	PACKING TO OBTAIN 3 PACKING TO OBTAIN 3	REAL ARAAYS') ,IHRI6		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2,14813,14814,14815	,I WRI6		
232 FORMAT (14 ,213) 233 FORMAT (14 ,213) 233 FORMAT (14 ,210) 18 [14 MIT - 80-1] 17 [14 MIT - 80-1] 17 [14 MIT - 80-1] 17 [14 MIT - 80-1] 17 [14 MIT - 80-1] 10 [14 MIT - 80-1] 10 [14 MIT - 80 MIT - 812 10 [14 MIT - 80 MIT - 812 10 [14 MIT - 80 MIT - 812 10 [14 MIT - 80 MIT - 812 11 [14 MIT - 80 MIT - 812 12 [14 MIT - 80 MIT - 812 13 [14 MIT - 80 MIT - 812 14 [14 MIT - 80 MIT - 812 14 [14 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 812 14 [14 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 812 14 [14 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80 MIT - 80 MIT - 812 15 [14 MIT - 80	2,IWRI3,IWRI4,IWRI5	,1 4816		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2,IWRI3,IWRI4,IWRI5 2211	,IWIG		
$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} $	2, IMRI3, IMRI4, IWRI5 2211	,IRI6		
$\begin{array}{c} \operatorname{reg}(\operatorname{rgg}(\operatorname{rgg}(\operatorname{rgg}(\operatorname{rgg}))) \\ \operatorname{rgg}(\operatorname{rgg}(\operatorname{rgg}(\operatorname{rgg}))) \\ \operatorname{rgg}(\operatorname{rgg}(\operatorname{rgg}) = 0) \\ \operatorname{rgg}(\operatorname{rgg}) = 0 \\ rgg$	C.IMRIJ, IMRI4, IWRI5	,I HRI6		
$\frac{17((4RT1.EQ.1)}{(4RT1.EQ.1)}$ $\frac{17((4RT1.EQ.1)}{(1)} = \frac{18 MUMA}{10}$ $\frac{13}{(1)} = 0$ $\frac{13}{(1)} = 1$ $\frac{13}{(1)} = 1$				
m(1) = WNUMA m(2) = 0 m(3) = 0 c strate c c c c c c c c c c c c c c dwar dwar <tdd< td=""><td>WRITE (3. 201) (WAP (IST) . IST=1 . NUMBPR)</td><td>I ATA ANTIN - 1</td><td></td><td></td></tdd<>	WRITE (3. 201) (WAP (IST) . IST=1 . NUMBPR)	I ATA ANTIN - 1		
<pre>N(2) = 0 N(2) = 0 N(3) = 0 C REARS INSTEAD 0 C REARS INSTEAD 0 C REAR SAME SIZE C ALF OF THE SAME SIZE C ALF</pre>	the land with the	Immaniati		
C NOTE:: WAY ARRAN C ARRAYS INSTEAD C C ARRAYS INSTEAD C C ALL BELL DATA) C ALL BELL DATA) C ALL OF THE ARRANCE C ARRAY C ARRAY HAS B L = NUMBER / 2 L = L + 1 DO 250 IA = 1, IIB = IIA + L				
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C (ALL REAL DATA) C (ALL OF THE ARRA C THE DATA MUST BE C ARRAY C AN ATTEMPT HAS B L = NUMBER / 2 L = L + 1 DO 250 IIA = 1, IIB = IIA + L	STANDARD REAL ARRAYS.	YS. HOWEVER, THI	THE DATA	
C THE DATA HUST BI C THE DATA HUST BI C ARRAY C AN ATTEMPT HAS I L = NUMBER / 2 L = L + 1 DO 250 L1 = 1 IIB = IIA + L	IN THE COMPLEX ARRAY IS ONLY STORED IN THE LAST	D IN 2	LAST	
C ARRY C AN ATTEMPT HAS C AN ATTEMPT HAS L = NUMBER / 2 L = L + 1 D0 250 LTA = 1 D0 250 LTA = 1	0	CELLS). THEREFORE	FORE	
C AN ATTEMPT HAS L = NUMBER / 2 LL = L + 1 DO 250 LT A = 1 IIB = LIA + L		THE REAL CELLS THROUGHOUT THE	JT THE	
L = NUMBER / 2 LL = L + 1 DO 250 IIA = 1 IIB = IIA + L	BE MADE TO ACCOMPLISH THAT	HRRE.		
LL = L + 1 DO 250 IIA = 1, IIB = IIA + L				
IIB = IIA + L				
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WAF(IID) = CHPI				
0035 250 WAP (IIC) = CMPLX (G-0-0)				
IP (IWRI2.EC	2221			
IF (IWRI2.EQ.1)	WRITE (3.201) (WAP (IST) . IST=1. WIMBER)	I. MUMBRRI		
C TAKE THE FOURIER	RM			
UDTTP/3 17, TDP	, IN V, S, IFSET, IFERR)			
17 PORMAT (TPRAR =	151 1			
	1074			

WRITE [3, 223] WRITE [3, 201] (WAF [IST], IST=1, HUMBE 0 1 1 1 1 1 0 0 0 0 0 0 0 1			
<pre>TF(TWAIJ.EQ.1) WRITE(3,201)(WAF(IST),IST=1,WUMBE D0 260 IIG = 1, 10 COTW(IIG) = 0.0 W = 0 W0 = 0 COTW(IIG) = 0.0 W0 = 0 C TRED(1,230) IDGRM,IDGRD FEED(1,231) (COTW(IIT).IIF = 1, IDGED), COMSD WRITE(3,232) IDGRM,IDGRD FEED(1,233) (COTW(IIT).IIF = 1, IDGED), COMSD WRITE(3,232) IDGRM,IDGRD FEED(1,233) (COTW(IIT).IIF = 1, IDGED), COMSD WRITE(3,232) IDGRM,IDGRD T0 20 WRITE(3,232) IDGRM,IDGRD T0 20 WRITE(3,232) COTW(IABC),INEC,COPD(IABC),IABC 220 WRITE(3,220) COWW(IABC),IC4,E20.5,'*(ST 221 WRITE(3,220) COWW(IABC),IC4,E20.5,'*(ST 222 WRITE(3,220) COWW(IABC),IC4,E20.5,'*(ST 222 WRITE(3,220) COWW(IABC),IABC),IABC 222 WRITE(3,220) COWW(IABC),IABC,COPD(IABC),IABC 222 WRITE(3,220) COWW(IABC),IABC,COPD(IABC),IABC 223 WRITE(3,220) COWW(IABC),IABC,COPD(IABC),IABC 223 WRITE(3,220) COWW(IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 220 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 221 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 221 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 221 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 222 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 223 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 223 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 224 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 225 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 225 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 226 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 227 WRITE(3,220) COWW(IABC),IABC),IABC),IABC 228 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC 229 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC 220 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC 220 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC 220 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC 220 WRITE(3,220) AREAL + COFW(IABC),IABC),IABC,IABC,IABC,IABC,IABC,IABC,IABC,IABC</pre>			
$\begin{array}{c} \text{COPMITIG} = 0.0\\ \text{Z60 COP (IIG)} = 0.0\\ \text{W} = 0\\ \text{W} =$	38)		
260 COPD (IIG) = 0.0 NO = 0 NO = 0 RAD (1,231) (COFM (IIF) IIF = 1, IDGRW , CONSN READ (1,231) (COFM (IIF) , IIF = 1, IDGRW , CONSN READ (1,231) (COFM (IIF), IIF = 1, IDGRW , CONSN RETE (3,231) (COFM (IIF), IIF = 1, IO RETE (3,231) (COFM (IIF), IIF = 1, IO RETE (3,232) IDGRW , IDGRW , TORRW , TORRW , IDGRW , CONSN WRITE (3,232) (COFW (IABC), IIG = 1, IO $100 228$ MAD = 1, 10 100 228 MAD = 1, 10 100 28 MAD = 1, 10 100 8 MAD = 1, 100 100 8 MAD = 1, 100 (0) 100 8 MAD = 1, 100 (0) 100 8 MAD =			
<pre> Wo = 0 Wo = 0 READ 1: TEAMSFER FUNCTION POLOTNOMIALS (2) READ 1: 2301 JOERN IDERD T226 FORMAT(' TRANSFER POLYNOMIALS '/10X,'NUHERATON 10 228 METTE 3: 1225 JOENN IDERD 227 FORMAT(' TRANSFER POLYNOMIALS '/10X,'NUHERATON 10 228 METTE 3: 227 JOENN (IABC), IABC 229 FORMAT(' TRANSFER POLYNOMIALS '/10X,'NUHERATON 10 228 METTE 3: 227 JOENN 229 FORMAT('SX, P20.5) CONSWACONSP 229 FORMAT(5X, PALPE COPPU(6) AREAL = RFREQ2 & AREAL - COPN(6) AREAL = RFREQ2 & AREAL - COPN(2) AREAL = RFREQ2 & AREAL - COPN(2) AREAL = RFREQ2 & AREAL - COPN(2) AREAL = RFREQ2 & AREAL - COPN(6) AREA</pre>			
C READ IN TRANSFER FUNCTION POLOTNOMIALS (2) READ (1,233) [COFN,IEGER READ (1,233) [COFN,IEGER] READ (1,233) [COFN,IEGER] READ (1,231) [COFN [IIG],IIG = 1, IDGEN], CONSD WRITE (3,232) IDGEN, IDGER] 1226 FORMAT (* TRANSFER POLYNOMIALS '/101, WURERATOR 1) 228 WRITE (3,222) COFN (IABC), IABC, COFD (IABC), JABC 229 FORMAT (5,222) COFN (IABC), J. 4(54*, 12, 1), 642, 220.5 , *(5** WRITE (3,222) CONSN,CONSD 229 FORMAT (5,222)) CONSN,CONSD 229 FORMAT (5,223) SAFAL + CON (8) RFREQ = (1+) * 4.1 229 FORMAT (5,220) SAFAL + CON (8) RFREQ = (1,1) * 4.1 RFREQ = (REL * 4.1) * 6.2331856) / (FERIDD * NUM BER) RFREQ = RFREQ2 * AREAL + CON (8) AREAL = RFREQ2 * AREAL + CON (8) AREAL = RFREQ2 * AREAL + CON (1) AREAL = RFREQ2 * AREAL + CON (2) AREAL = RFREQ2 * AREAL + CON (1) AREAL = RFREQ2 * AREAL + CON (1) AREAL = RFREQ2 * AREAL + CON (2) AREAL = RFREQ2 * AREAL + CON (1) AREAL = RFREQ2 * AREAL + CON (2) AREAL = RFREQ2 * AREAL + CON (1) AREAL = RFREQ2 * AREAL + CON (2) AREAL = RFREQ2 * AREAL + CON (2) AREAL = RFREQ2 * AREAL + COP (5) AREAL			
<pre>REND(1,230) IDGEN,IDGEN REND(1,231) [COFN(IIF),IIF = 1, IDGEN),CONSN REND(1,231) [COFN(IIF),IIF = 1, IDGEN),CONSD WRTE(3,232) IDGEN, IDGEN 1226 FORMTE(3,222) IDGEN, IDGEN,IABC 17) DO 228 IABD = 1, 10 DO 228 IABD = 1, 10 DO 228 IABD = 1, 10 C 200 NUTE(3,227) CON M(IABC, IABC,COPD(IABC),IABC 229 FORMAT(52,220.5) **(5**,I22,1)',66X,8200.5, **(5** WTTE(3,227) CON M(IABC),IABC,COPD(IABC),IABC 229 FORMAT(5X,F20.15,14X,F20.5) C 200 NUTE THE TANNEFER FUNCTION AT EAC 229 FORMAT(5X,F20.15,14X,F20.5) C 200 NUTE THE TANNEFER FUNCTION AT EAC 229 FORMAT(5X,F20.15,14X,F20.5) RFEEQ = ((W-1)*6.2831856)/ (FERIOD * NUMBER) RFEEQ = ((W-1)*6.2831856)/ (FERIOD * NUMBER) RFEEQ = ((W-1)*6.2831856)/ (PERIOD * NUMBER) AREAL = RFEQ2 * AERAL + COFN(6) AREAL = RFEQ2 * AERAL + COFN(1) AREAL = RFEQ2 * AERAL + COFN(2) AREAL = RFEQ2 * AERAL + COF</pre>			
<pre>FEAD(1,531) [COFD(IIG),IIG = 1, IDGED), CONSD WRITE(1,231) [COFD(IIG),IIG = 1, IDGED), CONSD WRITE(1,220) [126] [126] [126] [126] [126] [126] 11) 1226 FORMAT(1, TRANSFER POLYNOMIALS '/10X, WUMERATOR 14BG = 11- IABD 228 WRITE(1,229) CONSN, CONSD 229 FORMAT(5x,F20.5, '*(5**,122,')',6K,E20.5, '*(5** 229 FORMAT(5x,F20.15,14X,F20.5) 229 FORMAT(5x,F20.15,14X,F20.5) 229 FORMAT(5x,F20.15,14X,F20.5) 229 FORMAT(5x,F20.15,14X,F20.5) 225 W = W + 1 255 W</pre>			
<pre>WRITE (3, 232) IDGRN, IDGRN, IDGRD #WRITE (3, 232) IDGRN, IDGRN / 10 1226 FORMAT (* TRANSFER POLYNOMIALS '/10X, WUMERATON 1') D0 228 MARDE (3, 227) OCFN (IABC), IABC, COFD (IABC), IABC 227 FORMAT (5X, 220.5 '*1(5***, IZ,')', 6X, 820.5 '*1(5***) 229 WRITE (3, 227) OCFN (IABC), IS, UNESFER FUNCTION AT EAC 220 FORMAT (5X, 70.0 5) '*1(7**)', 6X, 820.5 '*1(5***)', 6X, 820.5 '*1(5***)', 6X, 820.5 '*1(5***)', 10', 6X, 820.5 '*1(5**)', 10', 10', 10', 10', 10', 10', 10', 10</pre>			
1226 WRITE (1, TRANSFER POLYNOHIALS '/10X, WUMERATOR 1') 1226 FORMAT (1 TRANSFER POLYNOHIALS '/10X, WUMERATOR 00 228 IABD = 1, 10 227 FORMAT (5x, 220.5, '*(5***',12,')', 6X, 220.5, '*(5***) RRITE (3, 227) CON (IABC), IABC, COPD (IABC), IABC 227 FORMAT (5x, 220.5, '*(5***,12,')', 6X, 220.5, '*(5***) 227 FORMAT (5x, 220.5, '*(5***), 12, ')', 6X, 220.5, '*(5***) 227 FORMAT (5x, 220.5, '*(5***), 15, 141, 720.5) 228 FORMAT (5x, 200.5, '*(5***), 15, 141, 720.5) 229 FORMAT (5x, 220.5, '*(7***), 15, 141, 720.5) 255 W = N + 1 256 M = N + 1 257 COMPUTE THE VALUE OF THE TRANSFER FUNCTION AT EAC 258 W = N + 1 259 W = N + 1 255 W = R + 1 260 COMPUTE THE VALUE OF THE TRANSFER FUNCTION AT EAC 278 D = RFREQ2 AREAL = RFREQ2			
11) 10 228 TABC 1, 10 221 FORMAT (5x, 220.5, '*(5**',12,')', 6x, 220.5, '*(5**',22)) 227 FORMAT (5x, 220.5, '*(5**',12,')', 6x, 220.5, '*(5**',22)) 228 VRITE (3, 227) (COF M (1ABC), IABC, COF D (IABC), IABC 229 FORMAT (5x, 220.5, '*(5**',12,')', 6x, 220.5, '*(5**',12,')', 5x, 230.5, '*(5**',12,',11,5, '*(5**',12,'), **, 200, 12, '*(1),	DATENTHOUSAN ALE I		
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228 WRITE (3, 227) COFN (IA) 227 FORMAT (57, 229) CONSN, 229 FORMAT (57, 229) CONSN, 229 FORMAT (57, 229) CONSN, 229 FORMAT (57, 229) CONSN, 255 N = N + 1 255 N + 1			
222 WRITE ($3, 229$) CONALT ($3, 229$) CONAL 229 FORMAT ($5x, F20, c5$, $13, 14$) 229 FORMAT ($5x, F20, 15, 14$) 255 N = N + 1 255 N + 1 255 N = N + 1 255 N + 1 25			
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$\begin{array}{c} \label{eq:relation} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} = ((\mathbb{N}^{-1}) \ast \mathbb{6}.2831856) / (\mathbb{P} \mathbb{R} \mathbb{R} \mathbb{I} \mathbb{O} \mathbb{P} \\ \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} = -\mathbb{C} \mathbb{O} \mathbb{P} \mathbb{N} (\mathbb{B}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = -\mathbb{C} \mathbb{O} \mathbb{P} \mathbb{N} (\mathbb{B}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{P} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{P} \mathbb{N} (\mathbb{B}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{P} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{P} \mathbb{N} (\mathbb{G}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{P} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{P} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{P} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{R} = \mathbb{R} \mathbb{C} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} + \mathbb{C} \mathbb{O} \mathbb{N} (\mathbb{C}) \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} = \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{A} \mathbb{L} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{C} \\ \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} \\ \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{A} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \\ \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{L} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \\ \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{Q} 2 \Rightarrow \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R} \mathbb{R}$	H FREQUENCY		
$\begin{array}{c} \overline{\mathtt{RFREQ2}} = \overline{\mathtt{RFREQ2} \ast \overline{\mathtt{RFREQ}} \\ \overline{\mathtt{RFREQ2}} = -\overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(7 \right) \\ \overline{\mathtt{ARFLG}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{AFFAL}} + \overline{\mathtt{COFM}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{AFFAL}} + \overline{\mathtt{AFFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2}} \ast \overline{\mathtt{ARFAL}} + \overline{\mathtt{ACOFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(6 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL}} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{RFREQ2} \ast \mathtt{ARFAL} + \overline{\mathtt{COFD}} \left(7 \right) \\ \overline{\mathtt{ARFAL}} = \overline{\mathtt{ARFAL} + \overline{\mathtt{ARFAL}} + \overline{\mathtt{ACA}} + \mathtt{$			
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265 GOUT GUE 264 TO 253 264 TO 254 1820187(1 = 'FI4.2) 'ST6.6,' BENGHIMATOR = ',ZF16.6,' 1820187(2 = 'FI4.2) 'SOMARD = ',ZF16.6,' 230 FORMT(14,25) 'SOMARD = ',ZF16.6,' 240 FORMT(14,25) 'SOMARD = ',ZF16.6,' C 239 FORMT(14,15) 'SOMARD = ',ZF16.6,' C 239 FORMT(14,15) 'SOMARD = ',ZF16.6,' 240 FORMTLE SOMARD = ',2000 (CONTRUE 17(18.11.00) 'SOMARD = ',2000 (CONTRUE 270 CONTRUE 270 CONTR		60					
C WITTE 13, 239, XUUM, NDEMON, RFERQ, RFERQ, DEMONTANDE = ',2816.6/' 230 FORMAT(1 WURBARDES = ',710.2) C WATTE(13,240) (QUCTWY (M1), M1=1,32) C UNDERT(13,240) (QUCTWY (M1), M1=1,32) C 240 FORMAT(14,201) C 299 FORMAT(14,201) C 299 FORMAT(14,201) T (148.45.1) C 200 FOLS 270 FORMATCS, 1817, 5,1757, 1728.1) T (148.45.1) C 718 FERVINE, 19,11 MATTE(3,224) T (148.45.1) T (148.45.1) T (148.45.1) T (148.45.20) (MATTE), 157-1, MUBER) T (148.45.20) (MATTE), 157-1, MUBER) T (148.45.20) (MATTE), 157-1, MUBER) T (148.45.20) (MATTE), 200 (MATTE), 157-1, 157	265	0					
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C THE PROPER FORM 100 271 IIH = 1, 11M = L + 11J 11M = L + 11J 11L = 11X + 2 11L = 11X + 7 271 WAF(IIM) = CMPL 271 WAF(IIM) = CMPL 15(IWAIG.EQ.1) RETURN END	υ	. EQ. 1) WRITE (3, 201) (WAF (I THE DATA BACK INTO ONE HA	ST) (IST=1, NUMBER)	80 T.U			
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LIST-11 LF (IWAIG. 20.1) RETURN EMD	117	-1					
LF(IMIL6.EQ.1) RBTURN EMD	LIST=L+1						
	LF (IWAIG- RETURN END	(1-05	ST) , IST=LIST, NUMBER)				
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$ \begin{array}{c} \textbf{C} \qquad \textbf{WOTE:} & \textbf{HERE AS} \\ \textbf{C} \qquad \textbf{RERIVED AI} \\ \textbf{C} \qquad \textbf{C} \qquad \textbf{RERVEJ} \\ \textbf{L} = \textbf{L} + \textbf{I} \\ \textbf{L} = \textbf{L} + \textbf{I} \\ \textbf{D} \qquad \textbf{C} \\ \textbf{D} \qquad \textbf{S} \\ \textbf{C} \qquad \textbf{LIC} = \textbf{L} \\ \textbf{LIB} = \textbf{L} - \textbf{IIA} \\ \textbf{H} = \textbf{AIRAG(SIGMAI)} \\ \textbf{R} = \textbf{L} \\ \textbf{C} \\ \textbf{R} \\ \textbf$	0025						
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$IIB = L - IIA + 1$ $IIC = IIB * 2$ $IIC = IIB * 2$ $IID = IIC - 1$ $B = A IHAG(SIGMAL(IIB))$ $B = A IHAG(SIGMAL(IIB))$ $S = REAL(SIGMAL(IIB))$ $S = REAL(SIGMAL(IIB))$ $S = REAL(SIGMAL(IIB))$ $S = REPLACON (S = C + PLX(H_0.0))$ $IF(UWR12-BC-1) WRITE(3,221)$ $IF(UWR12-BC-1) WRITE(3,221)$ $IF(UWR12-BC-1) WRITE(3,221)$ $IF(UWR13-BC-1) WRITE(3,221)$	0029	11 05	= 1,				
$\begin{array}{c} \text{IID} = \text{IIC} - 1 \\ \text{G} = \text{REAL}(\text{SIGMAL}(\text{IIB})) \\ \text{H} = \text{AIMAG}(\text{SIGMAL}(\text{IIB})) \\ \text{SIGMAL}(\text{ILD}) = \text{CMPLX}(\text{G},0.0) \\ \text{SIGMAL}(\text{ILC}) = \text{CMPLX}(\text{G},0.0) \\ \text{IP}(\text{IURL2-BG.1}) \text{ URITE}(3,222) \\ \text{IP}(\text{IURL2-BG.1}) \text{ URITE}(3,222) \\ \text{CALL} \text{HARM}(\text{SIGMAL}, \text{M}, \text{INV}, \text{S}, \text{IR} \\ \text{URITE}(3, 17) \text{ IPBRR} \\ \text{CALL} \text{HARM}(\text{SIGMAL}, \text{M}, \text{INV}, \text{S}, \text{IR} \\ \text{URITE}(3, 17) \text{ IPBRR} \\ \text{TP}(\text{IURL3-BQ.1}) \text{ WRITE}(3, 221) \\ \text{IP}(\text{IURL3-BQ.1}) \text{ WRITE}(3, 221) \\ \text{IP}(\text{IURL3-BQ.1}) \text{ WRITE}(3, 201) \\ \text{CON}(11G) = 0.0 \\ \text{COP}(11G) = 0.0 \\ \text{M} = 0 \end{array}$	0031	- 7 =	+				
G = REAL(SIGMAL(IIB)) H = AIHAG(SIGMAL(IIB)) SIGMAL(IIC) = CMPLX(G.0) SIGMAL(IIC) = CMPLX(G.0) IP(IURI2.EQ.1) WRITE(3,221) IP(IURI2.EQ.1) WRITE(3,221) C TAKE THE POUBLER TRANSFORM IF(IURI2.EQ.1) WRITE(3,221) C TAKE THE POUBLER TRANSFORM IP(IUR12.EQ.1) WRITE(3,221) IP(IUR13.EQ.1) IPERR IP(IUR13.EQ.1) WRITE(3,221) IP(IUR13.EQ.1) WRITE(3,201) D0 260 IIG = 1, 10 COP(IIG) = 0.0 W = 0	0032	1 11					
$ \begin{array}{l} H = & LHAG(SIGMAL(IIB)) \\ SIGMAL(IID) = & CMPLX(G_0) \\ SIGMAL(IIC) = & CMPLX(H_0.0) \\ IF(IURI2.EG.1) & WRITE(3,201) \\ TKE THE POURIZE TRANSFORM \\ TSEPT = & TRANSFORM \\ CALL HARM(SIGMAL, M, INV, S, IF \\ WRITE(3,17) & IFPRB \\ TRANSFORM \\ TF(IURI2.EQ.1) & WRITE(3,201) \\ IF(IURI3.EQ.1) & WRITE(3,201) \\ DO 260 & IG = & 1 \\ COD & COP (IIG) = & 0.0 \\ N = & 0 \\ \end{array} $	0033	G = REAL (S	_				
250 SIGMAL(LID) = CMPLX(H, 0, 0) 250 SIGMAL(LIC) = CMPLX(H, 0, 0) IF(IWRL2.EQ.1) WRITE(3, 22) IF(IWRL2.EQ.1) WRITE(3, 22) C TAKE THE FOURIER TRANSFORM TESET = 7 CALL HARM(SIGMAL, H, INV, S, IE WRITE(3, 17) IFERE 17 PORAT(1, 17) IFERE 17 PORAT(0034	H = AIMAG(IGNA				
TP (IURI2.EG. 1) WRITE (5.22) TRX THE FOURTER TRANSFORM TAKE THE FOURTER TRANSFORM TAKE THE FOURTER TRANSFORM TAKE THE FOURTER TRANSFORM TAKE THE FOURTER TRANSFORM CALL HARM (SIGMAL, H, INV, S, IE WRITE (3, 17) IFFERE TF(IWR13.EQ.1) WRITE (3, 201) TF(IWR13.EQ.1) WRITE (3, 201) DD 260 TIG = 1, 10 COPN (IIG) = 0.0 N = 0	0036		+ 1				
C TAKE THE FOURTER TRANSFORM TESET = TOURTER TRANSFORM CALL HARM(SIGNAL, H, INV, S, IF CALL HARM(SIGNAL, H, INV, S, IF URITE(3, 17) IFPER TF(HHI2, 20, 1) HRITE(3, 201) IF(LUBI3, EQ. 1) HRITE(3, 201) DO 260 IIG = 1, 10 COPN(IIG) = 0,0 N = 0	0037	IF (IWRI2.B					
$\begin{array}{c} \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 $	0038	E) WRITE (3,201)	(IST), IST=1, NUMBER)			
CALL HARM(SIGMA WRITE(3,17) IPE PORMA(3,17) IPE IF(IWR13,EQ.1) IF(IWR13,EQ.1) DO 260 IIG = 0.0 COFP(IIG) = 0.0 N = 0	6600		BR TRANSFORM				
WRITE(3,17) IF TF(LWAT3, Control IF TF(LWAT3, EQ.1) IF(LWAT3, EQ.1) TF(LWAT3, EQ.1) DO 260 TIG COFN(IIG) 0.0 260 COFN(IIG) N = 0	0040	CALL HARM (SIGNAL . M. INV . S. IPSET. TFF	RAI			
17 PORMAI(' IF IF(IWR13.EQ.1) IF(IWR13.EQ.1) D0 260 IIG = 1 COFN(IIG) = 0.0 260 COFD(IIG) = 0.0	0041	WRITE (3, 17)) IPERR	100			
IF(TWR13.EQ.1) IF(TWR13.EQ.1) D0 260 IIG = 1 COFN(IIG) = 0.0 260 COFD(IIG) = 0.0	0042	17 PORMAT (*	IPERR =				
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COPN(IIG) = 0.0 260 COPD(IIG) = 0.0 N = 0	0045	DO 260 IIG	L	(IST), IST=1, MUMBER)			
260 COPD(IIG) = N = 0	0046	COFN (IIG)	= 0.0				
1	0041	COPD (IIG)					
		1					

0049 NO = 0 00510 READ IN TRANSFER FUNCTION 00553 READ(1,231) [COFM(IIE),II 0053 READ(1,231) [COFM(IIE),II 0054 RETE(3,1231) [COFM(IIE),II 0055 READ(1,231) [COFM(IIE),II 0055 RETE(3,1232) IDGRN, IDGRD 0056 RETE(3,1232) [COFM(IIE),II 0055 1226 FORMAT(1,231) [COFM(IIE),II 0056 1226 FORMAT(1,232) [COFN(IIE),II 0059 2227 FORMAT(1,1220) [COFN(IABC),II 0059 227 FORMAT(5,2,220,5) [COFN(IABC),II 0051 229 FORMAT(5,2,220,5) [COFN(IABC),II 0051 229 FORMAT(5,2,220,5) [COFN(IABC),II 0061 229 FORMAT(5,2,220,5) [COFN(IABC),II 0065 N = N + N 0066 N = N + I 0065 N = N + I 0066 ARBAL = RFREQ2 + ARBAL + O 0067 ARBAL = RFREQ2 + ARBAL + O 007	NO = 0 EAD IN TRANSFRE FUNCTION POLOYMONIALS (2) READ(1,231) (DGRM,IDGRD READ(1,231) (DGRM,IDGRD READ(1,231) (COFM(IIF),IIF = 1, IDGRW),CONSN REITE(3,231) (COFD(IIG),IIG = 1, IDGRW),CONSD REITE(3,231) (COFD(IIG),IIG = 1, IDGRW),CONSD REITE(3,232) DGRM, IDGRD PORAT(* TRANSFER POLTHONIALS */10K, WUMERATOR *, 30K, 'DEMOMINATOR * RITE(3,1226) PORAT(* TRANSFER POLTHONIALS */10K, WUMERATOR *, 30K, 'DEMOMINATOR * RITE(3,1226) PORAT(* TRANSFER POLTHONIALS */10K, WUMERATOR *, 30K, 'DEMOMINATOR * RITE(3,1226) * RITE(3,227) COFN (IABC),IABC,COFD (IABC),IABC * RITE(3,227) COFN (IABC),IABC,COFD (IABC),IABC * RITE(3,227) COFN (100 * RITE(3,227) COFN (100 * RITE(3,227) COFN (100 * RERQ = ((M-1)*6.2831856)/ (PERIOD * NUMBER) RERQ2 = RERQ2 * AIRAL + COFN (9) AREAL = RFRQ2 * AIRAL + COFN (9) AREAL = RFRQ2 * AIRAL + COFN (10) AREAL + COFN (2) CONSN CONSD SON	INATOR		
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$\begin{array}{c} \text{READ}(1,230) \text{ ID}\\ \text{READ}(1,231) \text{ (C}\\ \text{READ}(1,231) \text{ (C}\\ \text{REATE}(3,232) \text{ ID}\\ \text{REATE}(3,225) \text{ (C}\\ \text{REATE}(3,222) \text{ (C}\\ \text{(REATE}(3,22) \text{ (C}\\ \text{(REATE}(3,23) \text{ (C}\\ $	<pre>IDGEND IIIGEND III), IIG = 1, IDGEND, , IDGED = 1, IDGED), POLTHOMIALS '/10%,'W abc), IABC,COPD(IABC), esset,I2,')',6%,820 CONSD *15**'I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',6%,820 esset,I2,')',10%,10%,10%,10%,10%,10%,10%,10%,10%,10%</pre>	CONSN CONSD HERATOR ', 30%, D) ABC ',*(S**',I2,')') M AT EACH FRFQUE (BER)	INCHINATOR		
$ \begin{array}{c} \text{FERD} (1,23) & (1,231) & (C\\ \text{FERD} (2,232) & (C\\ \text{FERD} (2,23) & (C\\ $	<pre>LITS, JIIG = 1, IDGED), TIG, JIIG = 1, IDGED), FOLTHOMLALS '/10%, W FOLTHOMLALS '/10%, W BOLTHOMLALS '/10%, W FOLTHOMLALS '/10%, W FOLTHOMLALS</pre>	CONSP CONSP (MERATOR ', 30%, "D) (ABC , '*(S**', I2, ') '))M AT EACH FRFQUE (BER)	INCHINTOR		
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$ \begin{array}{c} 1226 \\ \hline { \ \ \ \ \ \ \ \ \ \ \ \ \$	POLTHOMLALS '/10X,'W POLTHOMLALS '/10X,'W ABC, JABC, COPD (IABC). (55**,IZ2,')', 6X, 820. (4, 748, 720.5) F THE TRNNSFER FUNCTI F THE TRNNSFER FUNCTION F THE TRNSFER FUNCTION F THE	HERATOR ', 30%, "D	NOMINATOR		
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228 279 255 255	ABC), IABC, COPD (IABC), -(Set .12,1), .6X, B20. -(Set .12,1), .6X, B20. -(Set .12,1), .6X, B20. -(Set .12,1), .6X, B20. *X, P20.5) *X, P20.5) *X, P20.5) *X, P20.5) *X, P20.5) *X, P20.5) *X, P20.5) *X, P20.5 *X, P20.5		CT.		
228 227 229 255 255	ABC, ,IABC, COPD (IABC), *(5**, 12, 1), 6 X, 820. ,COR (10, 1), 6 X, 820. ,COR (2) F THE TRANSFER FUNCTI B31856) / (PERIOD * MU B31856) / (PERIOD * MU B31856 / (PERIOD * M	ABC (**',I2,')') '*(S**',I2,')') N AT EACH FRFQUE! (BER)	C7.		
227 255 255 255 2	#(5**, 12, 1) #(5**, 12, 1) CONSD CONSD THE THARFER FUNCTI FTHE TRANSFER FUNCTI 831856)/ (PERIOD * NU 821456)/ (PERIOD * NU 8214 COPN(8) 8214 COPN(8) 8214 COPN(8) 8214 COPN(8) 8214 COPN(9) 8214 COPN(9) 8214 COPN(9) 8214 COPN(9) 8214 COPN(1) 8214 COPN(1) 8214 COPN(1) 8214 COPN(1) 8214 COPN(1) 8214 COPN(1)		CY.		
c 229 255	CONSD 44, F20.5) F THE TRANSFER FUNCTI B31856) / (PEBIOD * MU B31856) / (PEBIOD * MU B31456) / (PEBIOD * MU B314560 / (IN AT EACH FRFQUE	CY.		
220 2355 2355	W1, P20.5) F THE TRANSFER FUNCTI 831856) / (PERIOD * NU EQ BEAL + COPN (8) BEAL + COPN (4) BEAL + COPN (4) BEAL + CONN (2) BEAL + CONN (3) ETAL + CONN (3) ETAL + CONN (3) ETAL + CONN (1) ETEG + COPN (1)	N AT EACH FRFQUE	CY.		
$\begin{array}{c} 255 & \text{CORPUE TAL VAL} \\ 255 & \text{WEREQ} = (1-1) \\ \text{RFREQ} = (1-1) \\ \text{RFREQ} = (1-1) \\ \text{RFREQ} = (1-1) \\ \text{RFRAL} = \text{RFREQ} \\ \text{AREAL} = RFRE$	F THE TRANSFER FUNCTI B31856) / (PERIOD * MU EQ EAL + COPM(8) EAL - COPM(4) EAL - COPM(4) EAL - COPM(4) EAL - COPM(3) EAL + CONSU EAL - COPM(3) EAL - COPM(3) EA	JM AT BACH FRFQUE) (BER)	CT.		
$ \begin{array}{c} \text{RPREQ} = & \text{R} + 1 \\ \text{RPREQ} = & \text{RPRQ} \\ \text{RPRAL} = - & \text{COFN} \\ \text{ARRAL} = & \text{RPRQ} \\ \text{ARRAL} = & \text{RPRRAL} = & \text{RPRRAL} = & \text{RPRRAL} = & $	1856) / AL + CO AL - CO AL + C	(BER)			
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UU9U ANDENUE CEPLA (ANDAL	(AKEAL, AIBIG)				
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C MULTIPLY THE VALUE	OF THE TRANSPER FUNCTION TIMES	ON TIMES THE VALUE	AU A		
SPECTRUM					
SIGNAL (N) = SI	(M) * QUOTNT(NO)				
IP (N- EQ. 1)					
NNO = NUMBER - N +	2				
IP(N.EQ.NNO) G	257				
SIGNAL (NNO) =	CONJG (SIGNAL (N))				
257 CONTINUE					
0099 IP (NO.EQ.32) GO TO 265	265				

0100 0101 0101 0101 0101 0101 0101 0101		G LEVEL 21 FLTRS DATE = 73332 00/31/53 PAGE 0003	
Z 265 CONTINUS C 240 FORMAT (1x, 9815, C 240 FORMAT (1x, 9815, C 240 FORMAT (1x, 6815, C 239 FORMAT (14, ris) IF (18 R14, EQ.1) IF (18 R14, EQ.1) IF (18 R14, EQ.1) IF (18 R14, EQ.1) IF (18 R15, EQ.1) RETURN END RETURN END	100	60	
C WRITE(3,240) ((240 FORMAT(11, 215) NO = 0 17 (N. 62.LL) GO 239 FORMAT(11, 215) NO = 0 17 (19814.20.1) 17 (19814.20.1) 17 (19814.20.1) 17 (19814.20.1) 17 (19815.20.1) 17 (19815.20.1) 18 (19815.20.1) 19 (19815.20.1) 10 (1	102	265	
C 239 FORMAT (14, 15) R(M = GR.LL) GO R(M = GR.LL) GO CONTENUE IF(IMRU4.EQ.1) C TAKE THE INVERSE TAKE THE INVERSE CALL HARM (SIGMAL RETE [3, 17) IFE IF(IMRE5.EQ.1) IF(IMRE5.EQ.1) C COMPRESS THE DNT C PROPER FORM (SIGMAL IF (IWRE5.EQ.1) RETURN (SIGMAL C PROPER FORM (SIGMAL IF (IWRE5.EQ.1) RETURN (SIGMAL C PROPER FORM (SIGMAL C PROPER C PROPER FORM (SIGMAL C PROPER C PROPER FORM (SIGMAL C PROPER C PROPER FORM (SIGMAL C PROPER C P	103	240 PORMAT (1V 8915	
239 FORMAT (14 , 15) R0 = 0 F(N = 62 , 15) 270 CONTINUE 1F(IERR44, EQ.1) FF(IERR44, EQ.1) TF(IERR44, EQ.1) FF(IERR44, EQ.1) FF(IERR54, EQ.1) FF(IERR55, EQ.1) FF(IERS55, EQ.1) FF(IER		WRITE (3,239) N	
IP(N-G) IP(N-G) GO IP(I-G) GO 270 GO TAKE THE IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) IP(I-G) <td>105</td> <td>239 PORMAT (1H , I5)</td> <td></td>	105	239 PORMAT (1H , I5)	
270 200 255 270 CONTINUE IF(IERNUE 1 IF(IERNUE E0.1) 1 IFELERAUE E0.1) 1 <td< td=""><td>106</td><td>GO TC</td><td></td></td<>	106	GO TC	
ZIVELENTE ENTRE THE INVERSE TFREETE INVERSES TFREETE INVERSES T	107	GO TO 255	
IF(IVERU.EV.1) C TAKE THE INVERSE CHLE HARM(SIGMA WRITE(3,17) IFE IF(UWERSE 20.1) IF(UWERSE 20.1) IF(UWERSE 20.1) IIJ IIJ IIJ III IIII III IIII IIII IIII IIII <td< td=""><td>60</td><td>TRITUDIN PO 11</td><td></td></td<>	60	TRITUDIN PO 11	
C TAKE THE INVERSE REFE INVERSE C TAKE THE INVERSE REFL HARM (SIGNAL REFL HARM (SIGNAL I [[HHE]5, EQ.1]) I [[HHE]5, EQ.1]) C C COMPRESS THE DAT C C MPRESS THE DAT I I J = 2 # IH I I J = 2 # IH I I J = 2 # IH 271 SIGNAL 271 SIGNAL 2	110	IF(IMRAL+202-1) MEILE(3.2024) (SIGNAL/IST) TEN=1 MEMBEDED	
The second secon		TAKE THE INVERS	
RTER (1,11) TF (1825. EQ.1) IP (1825. EQ.1) IP (1825. EQ.1) C COMPRESS FERSTER DO. D10 271 IH = 1, IF = 1, 1 IF = 1, IF = 1, 1 IF = 1, IF = 1, 1 IH = 1, IF = 1, 1 IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1, IF = 1,	12	IrSET = -1	
IP(IWRI5.EQ.1) IC COMPRESS FUE DAT C COMPRESS FUE DAT C COMPRESS FUE DAT IIX = 13 - 14 IIX = 13 - 14 A = REAL(SIGNAL 271 SIGNAL(IH) = C IP(IWRI6.EQ.1) RFTORM END RFTORM EQ.1)	13	URITE (3.17) IFREE PARTY (STEARL)	
IF(LBR5.80.1) C COMPRS.74B Dar C PROPER FORM POB IIJ 2 * IIH III 1 * ERAL(SIGNAL 271 S * RAL(SIGNAL 271 S * RAL(SIGNAL 271 S * RAL(SIGNAL III 1 * ERAL(SIGNAL 271 S * RAL(SIGNAL 271 S * RAL	14	IF(IHRI5.EQ.1) WRITE(3.225)	
C CORPERS THE DAT C PROPER FORM FORM FORM FORM FORM IIJ = 2 + II IIJ = 2 + II IIF = 1, -1 IF = 1, -1 A = REAL(SIGMAL) 271 FILMEL(ELL) - 1 C FUMEL(ELL) - 1 C FUMEL	15	IP(IMRIS. BQ. 1)	
D0 271 TH = 1, IIJ = 2 * IH IK = 150 - 1 A = REAL(SIGNAL 271 SIGNAL(ILH) = C IF(UWRL6.EQ.1) RETURN 6. EQ.1) END		DRODED POPM FOR	
IIJ = 2 * IIH IIK = IIJ - 1 A = REAL(SIGNA 271 SIGNAL(IIH) = IF(IVAR6.EQ.1) IF(IVAR6.EQ.1) END	16	DO 271 IIH = 1.	
A R E ALJ - 11 - 1 A = REAL(SIGNAL) B = REAL(SIGNAL) 271 E (IWRI6-EQ-1) FF(IWRI6-EQ-1) RETURN END	17	1	
A = REAL(SIGNA B = REAL(SIGNA 271 SIGNAL(ILS) IF(IWR16-EQ-1) RFTURN END END	18	- MII =	
271 SIGHAL(IH) 271 SIGHAL 271 SIGHAL	61	= REAL (SIGNA	
	240	B = REAL (SIGNA	
LF (IWR16.EQ.1) END END END	22	IF (INRI6-E0.1)	
N NO CON N	23	IF(IWRIG.EQ.1) WRITE(3,201) (SIGNAL (IST).IST=1.L)	
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PAGE 0002	STRBOL LO		STRBOL LOC	IOT IONAS		ND2	SYMBOL LOC		SYRBOL LOC										
00/31/53	LOCATION		LOCATION	LOCATTON	PC 110	124	LOCATION 5140		LOCATION 71CB									and the second	
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	/ MAP SYMBOL WAF	LED.	SYMBOL	SYMBOL	н J2	X	SYMBOL	AAP		T, DBCK, LOAD,	44 PROGRAM SI 2E								
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APPENDIX E

STANDARD OPERATING PROCEDURES

As mentioned in Section 6.0, a detailed standard operating procedure for z-axis rack alignment was developed for review by CDA personnel. This appendix documents that procedure.

Abbreviations

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SR 1 = Scanning Radiometer Number 1
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SR 2 = Scanning Radiometer Number 2

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IR = Infrared
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VIS = Visible
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F&W = Flutter and Wow
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SRR = Scanning Radiometer Recorder

S/C = Spacecraft

MUX = Multiplexer

DEMUX = Demultiplexer

RT = Real Time (CDA Tape Recorder set to 60 ips)

ST = Slow Time (CDA Tape Recorder set to 30 ips)

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A7 Control
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Panel = Z-Axis Compensation Rack main control panel A7J3 A7J4 : Connectors or test points 3, 4, ..., 16 on : control panel A7

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A7J16
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DVM = Digital Voltmeter (dc)

Note: The nomenclature RT F&W Discriminator #1, ST F&W Discriminator #2, etc. conforms to the RCA schematic for Rack 48 (last revision dated 5 December 1970). Connector designations are also based on this schematic.

List of Test Equipment

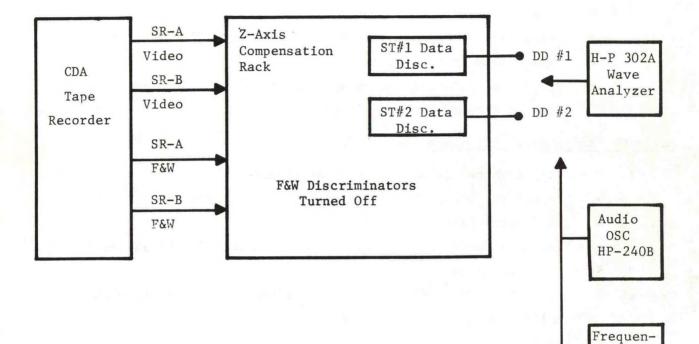
1	ea.	H-P	302 Wave Analyzer
1	ea.	H-P	240B Audio Oscillator
2	ea.	H-P	5245L Counter
1	ea.	H-P	3430A Digital Voltmeter (dc)
1	ea.	Ball	lentine 320 ac VTVM.

Z-Axis Alignment Standard Operating Procedures - Perform the following Daily Checks:

- (1) F&W Discriminator Zero Balance
- (2) Data Discriminator and VCO Balance

<u>Initial Set-Up For Delay Adjustment</u> - (This initial set-up should only have to be done once. If pre-pass checks start to vary, this operation should be redone after notifying Suitland)

- 1. ST Mode Reference Data (Figure E-1)
 - a. Put test tape on recorder and set for ST/Ch A playback and 15 ips.
 - b. Connect H-P 302A Wave Analyzer to DD#1 and tune to f_{fL} (check with audio osc. and frequency counter). Turn off all F&W discriminators.
 - c. Adjust all delay line controls for minimum delay and set control panel for ST #1 operation.
 - d. Playback about 3 min. of tape and record 302A reading. Rewind tape to its starting point.
 - e. Tune HP 302A to f_{fH} (check with audio osc. and frequency counter) and repeat step 1.d.
 - f. Connect HP 302A to DD #2 and repeat steps 1.b. through 1.e. with control panel set to ST #2 operation.
 - g. Set tape recorder for ST/Ch B playback and 15 ips.
 - h. Repeat steps 1.b. through 1.f.
- 2. ST Mode Alignment (Figure E-1 with F&W Discriminators turned on).
 - a. Put test tape on recorder and set for ST/Ch A playback and 15 ips.
 - b. Set control panel to ST #1 operation and all F&W discriminators turned on.
 - c. Connect HP 302A tp DD #1 and tune to ${\rm f}_{\rm fH}$ (check).
 - d. Start tape recorder and adjust delay unit #1 until a minimum reading is obtained on the 302A. Record reading.
 - e. Rewind test tape to its start point.
 - f. Adjust 302A to f_{fI} and check.
 - g. Start tape recorder and record 302A readings. Let tape play through to the end. Rewind tape.
 - h. Set system for ST/Ch B playback.
 - Repeat steps l.a. through l.f. but DO NOT ADJUST DELAY LINE (just record readings on 302A).



Use to Set Frequency of Wave Analyzer

cy Counter HP-5245L

Figure E-1. Initial Set-up for Delay Adjustment.

- j. Set system for ST/Ch A playback and 15 ips.
- k. Set control panel to ST #2 operation and all F&W discriminators turned on.
- 1. Connect 302A to DD #2 and tune to f_{fH} (check).
- m. Start tape recorder and adjust delay unit #2 until a minimum reading is obtained on the 302A. Record reading.
- n. Repeat steps 1.d. through 1.g.
- o. Tune 302A to f_{fH} and check.
- p. Start tape recorder and record 302A reading. Rewind tape.
- q. Adjust 302A to f , and check.
- r. Start tape recorder and record 302A readings. Let tape play to the end and rewind tape.

Daily Check for Delay Adjustment

- 1. For data playback, connect as follows (Figure E-2).
 - a. Connect HP 302A to DD #1 and tune to f_{fH} (check).
 - b. Set Control Panel to ST #1/Ch A operation.
- c. Place test tape on tape recorder and set recorder to 15 ips.

2. Start tape recorder

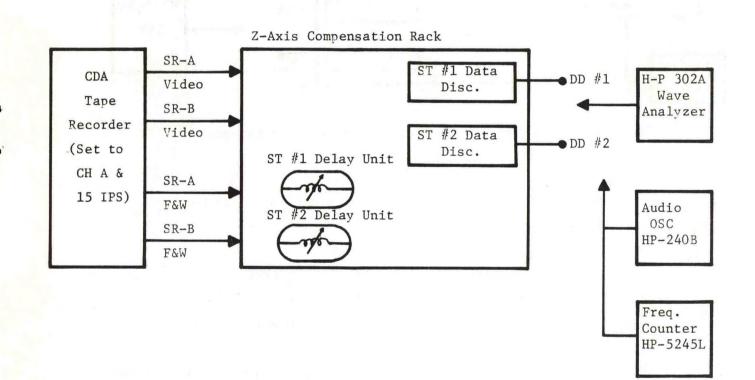
- a. Adjust Delay Unit #1 for minimum reading on 302A (start with smallest delay increment, i.e. 25 μs).
- b. Record reading.
- c. Tune 302A to f_{fT} (check) and record reading.
- d. Stop and rewind tape.
- 3. Set Control Panel to ST #1/Ch B operation.
 - a. Tune 302A to f_{fH} (check).
 - b. Start tape recorder and record 302A reading. Stop tape.
 - c. Tune 302A to f_{fI} (check).
 - d. Start tape recorder and record 302A reading.
 - e. Stop and rewind tape.
- 4. Set Control Panel to ST #2/Ch A operation.
 - a. Connect 302A to DD #2 and tune to f_{fH} (check).
 - b. Start tape and adjust Delay Unit #2 for minimum reading on
 302A (start with smallest delay increment, i.e., 25 µs).
 - c. Record reading.
 - d. Tune 302A to ${\rm f}_{\rm fL}$ (check) and record reading.
 - e. Stop and rewind tape.

5. Set Control Panel to ST #2/Ch B operation.

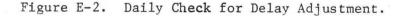
a. Repeat steps 3.a through 3.e.

6. Inform DDHS of any changes in Delay Unit Adjustments.

ST OPERATING MODE



Use to Set Frequency of Wave Analyzer



OTHER DAILY CHECKS

1. F&W Discriminator Zero Balance (Figure E-3)

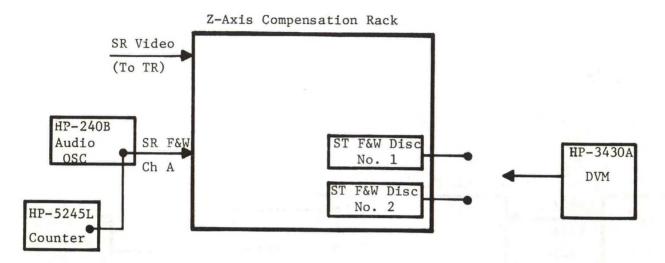


Figure E-3. F&W Discriminator Zero Balance Test Set-Up.

- a. Set Audio Oscillator to 1 v. (rms) output and 6.25 KHz. <u>+</u> 20 Hz.
- b. Connect DVM to ST F&W Disc. No. 1.
- c. Switch Control Panel to ST #1 Channel A operation.
- d. Adjust BAL control on front panel of Model 287T Channel Selector Plug-In of ST #1 F&W Reference Discriminator for 0 ± 0.005 volts dc on DVM.
- e. Set BANDEDGE VOLTS Control on RT #1 F&W Reference Discriminator fully clockwise.
- f. Connect DVM to ST F&W Disc. No. 2.
- g. Switch Control Panel to ST #2.
- h. Repeat 1.d. and 1.e. for ST #2 F&W Reference Discriminator.

2. Data Discriminator and VCO Balance (Figure E-4)

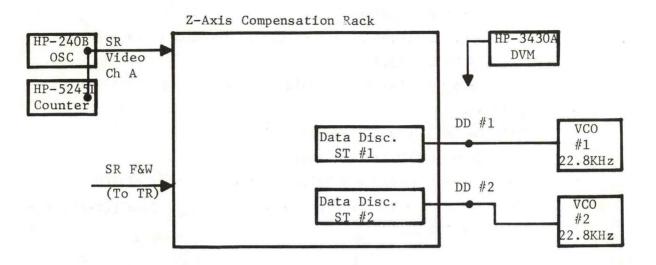


Figure E-4. Data Discriminator and VCO Balance Test Set-Up.

- a. Turn ST #1 and ST #2 F&W Discriminators off. Use DVM on their outputs (see 1. for connectors) to verify 0 volts dc output.
- b. Set Audio Oscillator to 1 volt (rms) output and 22.8 KHZ. \pm 20 Hz.
 - (1) Switch Control Panel to ST #1.
 - (2) Connect DVM to DD #1.
 - (3) Connect second H-P 5245L Counter to output of VCO #1.
 - (4) Adjust BAL control of ST #1 Data Discriminator for 0 + .005 volts dc on DVM.
 - (5) Adjust FREQ. Control of VCO #1 for a frequency output of 22.8 KHz. + 20 Hz. on second counter.
 - (6) Set Audio Oscillator to 1 volt (rms) output and 26.4 KHz + 20 Hz. (UBE)
 - (7) Adjust BANDEDGE VOLTS control on ST #1 Data Discriminator for + 5.0 volts dc on the DVM.
 - (8) Adjust INPUT control of VCO #1 for an output frequency of 26.4 KHz. + 20 Hz. (UBE) on second counter.
 - (9) Set Audio Oscillator to 1 volt (rms) output and 19.2 KHz. + 20 Hz. (LBE)

- (10) Reading on DVM should be approximately -5.0 volts (record reading).
- (11) Record frequency out of VCO #1 (should be 19.2 KHz. + 20 Hz. LBE).

c. Set Audio Oscillator to 1 volt (rms) output and 22.8 KHz. + 20 Hz.

- (1) Switch Control Panel to ST #2.
- (2) Connect DVM to connector DD #2.
- (3) Connect second H-P 5245L counter to output of VCO #2.
- (4) Repeat 2.b.(4) through 2.b.(11) on ST #2 Data Discriminator and VCO #2.

Master Test Tape Recording

 In order to align the z-axis rack, it is required that only a single tone be recorded on the visible and/or IR tracks of the SRR. This means that the portion of the SR Processor which multiplexes the SR output with telemetry, step wedge, etc., data must be defeated.
 The two equipments which will lead to the greatest time delay difference between the SR IR/Visible channel and the F&W channel are the spacecraft multiplexer and the ground-station demultiplexer. In recording the master tape, it is required that MUX, DEMUX and 14track tape recorder be as similar as possible to the actual operational equipment.

3. The diagram in Figure E-5 indicates roughly how the tape is to be made. No Visible, Data or telemetry are shown since none of these signals are desired. No particular attention has been given to levels; however, attenuators or amplifiers may be necessary. The four cables from the output of the DEMUX to the 14-track tape recorder should all be of equal length. If possible, a virgin tape should be used on the 14-track recorder and it should be completely filled (endto-end on tracks 5, 7, 9, 11) with test tone data. The two most important points to remember about this test tape are

(a) Continuous tones must be recorded on tracks 5, 7, 9, 11 of the 14-track recorder. Thermal vacuum data are not sufficient since they are not constant in amplitude due to the time-multiplexed data on the SR video output.

(b) Short of changing the spacecraft connections to eliminate unwanted data, the system should be as close as possible to operational conditions.

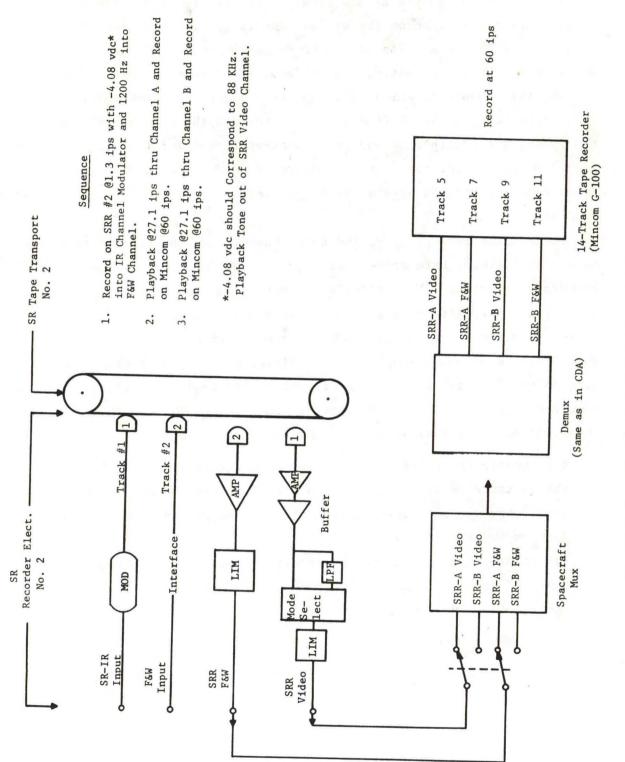


Figure E-5. Master Tape Recording Set-Up.

10.0 REFERENCES

- 2-1. Carlson, A. B.: <u>Communication Systems An Introduction to Signal</u> and Noise in Electrical Communication. McGraw-Hill, 1968.
- 2-2. Black, H. S.: Modulation Theory. Van Nostrand, 1962.
- 3-1. EMR Model 287A-02 Subcarrier Discriminator (Revision E) Instruction Manual, EMR Telemetry, April 1970.