

# NASA TECH BRIEF

## *Lyndon B. Johnson Space Center*



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### Spectral Analysis Program (SAP)

#### The problem:

Computation of the power spectrum for a high-frequency communication system is a difficult and time-consuming process, even with a high-speed digital computer. This is particularly true when the carrier is phase or frequency modulated by a complex signal.

#### The solution:

To solve this problem, a Spectral Analysis Program (SAP) has been developed that addresses itself to eliminate or reduce the time-consuming aspects of the computation.

#### How it's done:

SAP can handle the large number of data samples required to represent all of the frequency components in a modulating signal. It considers the nonlinearity of the angle modulation process as a series represented computation, which, theoretically, generates an infinite quantity of new frequency components. By using the extended, fast Fourier transform, the power spectrum computations are reduced to a manageable quantity. In addition angle modulation of the system is evaluated by low-pass filtering the modulating signal and/or band-pass filtering the modulated signal.

SAP either accepts an externally supplied modulating signal stored on tape or internally generates a sum of sinusoids signal, a periodic square wave, or a periodic multilevel signal. After acceptance or generation, the input modulating signal may be low-pass filtered using either a Butterworth, Chebyshev, or user-defined filter. The signal is then multiplied by the modulation process. Next, the modulated signal may be bandpass filtered using the same filters. Finally, the power spectrum is computed, printed and stored on a magnetic tape.

#### Notes:

1. This program is written in FORTRAN IV for the UNIVAC-1230 or 1108 computer.
2. Inquirers concerning this program should be directed to:

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