PANEL DISCUSSION

TECHNOLOGY FORECASTING AND ASSESSMENT

Moderators

Al Clavin
Hughes Aircraft Company
Missile Division
Canoga Park, CA

Warren Cooper
Westinghouse Electric Corporation
Advanced Technology Labs
Baltimore, MD

Abstract

Four areas of microwave technology will be addressed by members of the panel. These areas are Low Noise, High Power, Microwave Computer Logic, and Submillimeter Waves. It is desired to have a free exchange of information and questions between the audience and the panel members. A summary of both the audience and panel member discussions and comments will be published in the MTT Newsletter.

Technology Forecasting of Receivers in Systems Applications - S. Okwit, LNR Communications, Inc., Hauppauge, N. Y.

Modern day problems such as the energy crisis, pollution, etc. will play an increasing role as an important system parameter for the design engineer. A typical example of the involvement of low noise receivers in system tradeoff studies for energy conservation is readily seen in large ground based radars. For a given radar range requirement there is a tradeoff between transmitter power and receiver sensitivity Range $\alpha \left(\frac{\text{transmitter power}}{\text{system noise temperature}}\right)^{\frac{1}{4}}$. It is clear that if one can improve the system sensitivity by 3 dB the transmitter power requirements correspondingly decrease by 3 dB. The impact this has on prime power requirements is substantial. When one determines the large number of radars being employed in this country and the amount of power used to support these radars, the dynamics of receiver improvement as a conservation tool becomes evident.

The above is only one example of how environmental, social, and economic conditions of the future will dramatically affect how systems are configured.

High Power - J. E. Grant, Hughes Aircraft Company, Torrance, Calif.

The technology forecast for high power is predicated on new system requirements. Power levels have historically been dictated by system requirements where the necessary funding level could be justified. Little effort has been spent in the past to advance the microwave component art without regard for some system application. This trend is certainly expected to continue.

In general, power increases are expected to be modest. The most notable exception is in the area of communication satellites where power levels are expected to increase substantially by as much as two orders of magnitude. However, the user is becoming increasingly more interested in other characteristics such as wider bandwidth, higher efficiency, better linearity, lighter weight, lower cost and higher reliability even at the expense of reduced power. Taken separately, these characteristics are available in present day amplifiers, but taken simultaneously many compromises have been necessary. Although no dramatic breakthroughs are anticipated the user will expect few compromises in the future particularly in the area of cost and reliability.

Future trends in high power are examined relative to three principle markets — communications, radar and ECM. Trends in other performance characteristics are also considered such as bandwidth, efficiency and linearity.

Microwave Computer Logic and the Future - B. T. Murphy, Bell Telephone Labs, Murray Hill, N. J.

Traditionally the microwave engineer has been concerned only with the front-end of systems where relatively few microwave devices are used. This is changing to some extent with the advent of phased array systems where receivers and transmitters may be replicated thousands of times, although the number of systems may be few.

The application of microwave semiconductor logic elements in communications and computers in a field is expanding rapidly. Demands for increased speed for logic operations in the communications and computer field are moving the frequency spectrum up into the gigahertz range so that the application of microwave techniques is mandatory. The talk and discussion will cover the status and problems unique to ultra-high speed logic. Limitations due to fabrication processes and the potential of novel logic elements such as TED's will be covered, as well as the future needs for still higher speed elements.

Future Prospects for Submillimeter Waves - K. J. Button M.I.T. National Magnet Lab, Cambridge, Mass.

Many new components are being developed and many applications are emerging apparently at an accelerating rate. We have always thought that submillimeter waves are useless because they will not transmit through the water vapor in the atmosphere and also because we did not have a source of submillimeter radiation. Now we have submillimeter laser sources operating at more than 50 different frequencies. A tunable source of radiation has also been developed. The applications are appearing even in the newest technologies as the measurement of energy and density of deuterium and tritium ions in the plasmas of controlled nuclear fusion prototype machines. Some of the new components and techniques are extensions of microwaves; others are drawn from the optical end of the spectrum. The MTT Society has sponsored the First International Conference on Submillimeter Waves (Atlanta, June,1974) and also the Second Conference (San Juan, December 6-10, 1976). This is clearly a rapidly growing technology. Some of the growth factors and directions will be discussed.