VIII-1 REALIZATION OF MICROWAVE CIRCUIT FUNCTIONS USING ACOUSTIC WAVES

E.A. Ash (Invited)

University College, London

The existence of materials having a very low acoustic loss per wavelength, and the recent marked advances in the performance of transducers at microwave frequencies, suggest that it might prove possible to construct microwave components using acoustic waves. The main attraction of this possibility is seen to lie in the size reduction, by a factor of 10^5, which is implied.

Most of our work to date has been concerned with the realization of a dispersive delay line, using acoustic surface waves. Simple Rayleigh waves propagating on a surface are not dispersive, but can be made so by the addition of a thin film of a different material. Numerical solution for the dispersion equation for isotropic materials have been obtained. Experiments have been conducted at a frequency of a few megacycles, and are in very good agreement with theory (up to the cut-off frequency of the first higher mode). A high degree of linearity in the group delay characteristic is found, and in a pulse compression system should allow compression ratios of around 100 at 100 mc. Systems which might be suitable for microwave frequencies are presently being studied (e.g. layer of SiO_2 on Si). The thickness of the film required lies in the normal thin film technology range. The use of multiple films in order to achieve further improvements in group delay linearity is being investigated.

The possibility of using surface waves for realizing resonators and filters is being studied. We have shown that the reflection of a surface wave must always lead to a certain amount of mode conversion. A fundamental problem, which we are currently studying, is therefore to discover whether this mode conversion can be made so small that the effective loss and interference effects do not significantly detract from the component performance.

Some other possibilities, not dependent on surface wave reflection will be briefly discussed.