## Digest of Tech. Papers The 11th Conf. (1979 International) on Solid State Devices, Tokyo

C - 5 - 5

SURFACE ACOUSTIC SOLITONS

J. F. Ewen and R. L. Gunshor School of Electrical Engineering and V. H. Weston Division of Mathematical Sciences Purdue University West Lafayette, Indiana 47907 U.S.A.

There is a growing interest in the study of solitary wave propagation in a variety of media. Of particular interest here is the evaluation of device-compatable materials capable of supporting soliton propagation. The objective of this paper is the presentation of the results of our preliminary investigation into the propagation of solitary waves on the surface of piezoelectric media.

The first observation of solitary waves was reported by J. Scott-Russell in 1844 when he witnessed such a wave traveling along a shallow canal. One of the remarkable properties of these waves is that the shape of the soliton or pulse "perturbation" will remain constant even though the medium is both nonlinear and dispersive. In addition when two such waves collide, they emerge from the interaction with their shapes and velocities unchanged. The stationary nature of the wave can be understood as a balance between the nonlinearity and the dispersion. The fact that many SAW configurations are characterized by both nonlinearity and dispersion leads one to consider the possibility of solitary wave propagation in SAW media.

An analysis of SAW solitons can proceed with an examination of a one-dimensional phenomenological model of SAW propagation. This model is an adaptation of one previously employed for the study of SAW harmonic generation, and has been modified to include both nonlinearity and dispersion. By application of a suitable coordinate transformation, we demonstrate that this equation reduces to the Korteweg-deVries equation which gives solitary wave solutions. The results of this analysis are used to examine and evaluate a number of different SAW configurations with respect to solitary wave propagation characteristics. Implicit in this process is an attempt to fit our model to available published data concerning nonlinearity and dispersion of the various SAW configurations.

The results of analyses of several configurations including overlay waveguides, plate modes, and the multistrip coupler configuration will be discussed. Experiments aimed at verification of the phenomenological model are in progress, and preliminary results will be reported.

-247-

