ABSTRACT

INVESTIGATION OF WAVES IN NONLINEAR TRANSMISSION LINES BY WAVELET AND FOURIER TRANSFORMS

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M.Sc. Thesis, Department of Physics
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2010, 104 pages

This work has been conducted to investigate wave propagating in nonlinear transmission lines by Fourier and wavelet methods. For this purpose, nonlinear transmission lines equivalent of one dimension nonlinear crystal lattice with the first neighbor and the second neighbor interaction was constructed in Electronic Workbench. Propagation of the waves with different frequency and amplitude in the lines, and difference between the lines' reactions to the waves was examined. Nonlinearity was controlled by offset voltage. Data are obtained from transient analysis by using Electronic Workbench software. Fourier analysis graphics indicated frequency transfer among the mods, and wavelet graphics showed energy distribution between mods. It was observed that the waves propagating in the nonlinear transmission lines create new harmonics as their amplitude and frequency increase, and their energy is share among other mods, and as the wave frequencies increase, lower amplitude waves were observed to be needed for new mods to be created. For long wavelength wave nonlinear transmission line show continuum characteristics and wave equation obeys KdV equation and symetry properties of this equation was established relation with wave propagating. It is found that long range interactions makes soliton more stable and prevents their decaying into more solitons. It was expected the energie distribution among modes because of nonlinearity, not to be, only among a few modes. Therefor by changing range of interactions and nonlinearity between unit cells one can arrange the number of solitons and their propagation characteristics. Therefor nonlinear transmission line used in this work is quite useful in soliton generation, to work on non-ergodicity and recurrence. One can easily balance nonlinearity and dispersion. It is found that the line used can behave as a frequency converter.

Keywords: Nonlinear transmission line, Fourier Wavelet transform, FPU, soliton, dispersion