# Nonlinear Wave Modulation in a Fluid-Filled Elastic Tube with Stenosis

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In the present work, treating the arteries as a thin-walled and prestressed elastic tube with a stenosis and the blood as a Newtonian fluid with negligible viscosity, we have studied the amplitude modulation of nonlinear waves in such a composite system by use of the reductive perturbation method. The governing evolution equation was obtained as the variable coefficient nonlinear Schrödinger (NLS) equation. By setting the stenosis function equal to zero, we observed that this variable coefficient NLS equation reduces to the conventional NLS equation. After introducing a new dependent variable and a set of new independent coordinates, we reduced the evolution equation to the conventional NLS equation. By seeking a progressive wave type of solution to this evolution equation we observed, that the wave trajectories are not straight lines anymore; they are rather some curves in the $(\xi, \tau)$ plane. It was further observed that the wave speeds for both enveloping and harmonic waves are variable, and the speed of the enveloping wave increases with increasing axial distance, whereas the speed of the harmonic wave decreases with increasing axial coordinates. The numerical calculations indicated that the speed of the harmonic wave decreases with increasing time parameter, but the sensitivity of wave speed to this parameter is quite weak.

*Key words:* Solitary Waves; Tubes with Stenosis; Wave Modulation.