The Generation and Analysis of Waves with Varying Nonlinearity

Wehr, Thorsen

Many waves formed in nature are primarily linear and have a property called dispersion, causing different waveforms to separate and lose amplitude. Solitons can retain their pulse form as they propagate and cancels out that dispersion, making nonlinear waves useful for transferring energy. In a chain of spheres, the waves traveling throughout would display nonlinear behaviors when struck with enough force causing separation in the chain; the sound would not reflect back through the system disrupting the wave. Also in a chain of spheres, the waves traveling within would display nonlinear behaviors; the stress from the spheres' masses would cause deformation in the chain. Waves traveling in them become nonlinear. The first trials tested wave behaviors with different amounts of striking force. A test-sphere was placed atop the chain and struck with various forces. The second trials tested wave behaviors with a consistent force, changing the location of the test-sphere in the chain. The third trials tested wave behaviors with a consistent force, changing the location of the test-sphere in the chain and applying varying forces to the chain. This research was considered a success because both hypotheses were accepted and supported by statistical analysis. The nonlinearity of higher and lower forces and the nonlinearity of top and bottom test-sphere positions were statistically different.

Awards Won: