NASA TECH BRIEF

One-Dimensional Coulomb-Damped Wave Motion in Prismatic Bars

Although there have been numerous analyses published on wave motion from many standpoints, there appear to be no publications on wave motion with coulomb damping. A study was therefore undertaken in an initial attempt to analyze wave motions in prismatic bars with coulomb damping, using Laplace transforms as an aid in solving the partial differential equations. The results of this study have been detailed in a report. Wave motion without coulomb damping is presented first to establish the fundamental characteristics of wave motion. The report then presents the solutions which were successfully obtained for the equations of wave motion with coulomb damping.

In the chapter on wave motion without coulomb damping, semi-infinite and finite rods are considered. For the semi-infinite rod, three types of impulse loadings are analyzed: step stress, square wave stress, and step velocity. The finite rod is analyzed for free and fixed right-end boundary conditions. Impulse loadings of a step stress, square wave stress, square wave velocity and triangular wave stress are considered for the free right-end condition, and square wave stress and triangular wave stress for the fixed right-end boundary condition.

In the chapter on wave motion with coulomb damping, only a few cases are solved because of the difficulty in obtaining solutions; however, both the semi-infinite rod and finite rod are considered. For the semi-infinite rod, impulse loadings of step stress and square wave stress for $\tau = \alpha/2c$ and $\tau \geq \alpha/c$ are analyzed, and for the finite rod, a step stress is analyzed. In these expressions, τ is the pulse duration, α is the maximum wave propagation distance, and c is the wave propagation velocity.

In Chapter V, the effects of friction-induced wave motion are presented for the inducing wave propagation velocities of twice, equal to, and one-half of the propagation velocity of the induced wave. In the last chapter, the advantages and disadvantages of the Fourier transform technique as applied to wave motion are presented.

Note:

Documentation is available from:
Clearinghouse for Federal Scientific and Technical Information
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No patent action is contemplated by NASA.

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