SAE 2008-01-0175

Crash Pulse Modeling of Force Limiting Structures

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ABSTRACT

Equations of motion for constant stiffness and constant force structural behavior are merged and extended to model the crash pulse of a structure that transitions from constant stiffness behavior at low crush to approach force saturation at higher crush. The crash pulse is divided into two regimes for modeling, dynamic compression and rebound.

This merged ordinary differential equation produces a series of trigonometric-like functions that have adjustable characteristics such that they behave as the *sine*, *cosine*, and tangent functions at one extreme (constant stiffness structural behavior) and behave as polynomial functions at the other extreme (constant force structural behavior). Of particular interest is the modeling of structural behavior between these two limit behaviors.

The crash pulse model is applied to crash test data to illustrate the utility and application of these functions to represent acceleration, velocity, and displacement waveforms during a crash event of a structure exhibiting force limiting behavior. It follows that a successful representation of the acceleration pulse implies that the velocity pulse and displacement pulse are also well modeled.