HALF-SINE PULSE SYNTHESIS VIA A WAVELET SERIES FOR SHAKER TABLE SHOCK TESTS

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January 27, 2010

Introduction

Certain components must be subjected to half-sine acceleration shock tests. The acceleration is applied as a base input to the component. These tests are usually performed using a drop tower of some sort.

Half-sine tests can also be performed on a shaker table in some cases, depending on the table's respective displacement, velocity, acceleration and force limits. Furthermore, any shock test performed on a shaker must have zero net velocity and zero net displacement. Thus pre- and post-pulses are required for a half-sine shock on a shaker table.[1]

The purpose of this tutorial is develop a method of synthesizing a series of wavelets to represents a half-sine pulse, including the pre- and post-pulses. Note that wavelets both individually and as a series have zero net displacement and zero net velocity. Further information on wavelets is given in Reference 2.

A similar approach could be used for other types of classical pulses, such as sawtooth pulses.

Example

Consider a 50 G, 11 millisecond half-sine pulse. Develop a symmetric time history to satisfy this specification using a wavelet series. Limit the pre- and post-pulses to less than 10 G.

Furthermore, minimize the resulting displacement so that its peak absolute value is less than 0.75 inch.

The synthesis is carried out in a trial-and-error manner using Matlab script: half_sine_synth.m and its function wgen_hs.m.

The resulting acceleration, velocity and displacement are shown in Figures 1, 2, and 3, respectively. The maximum and minimum displacements are 0.50 and -0.71 inches.

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[1] Note that the initial velocity and initial displacement are each for shaker shock tests. See Reference 1.

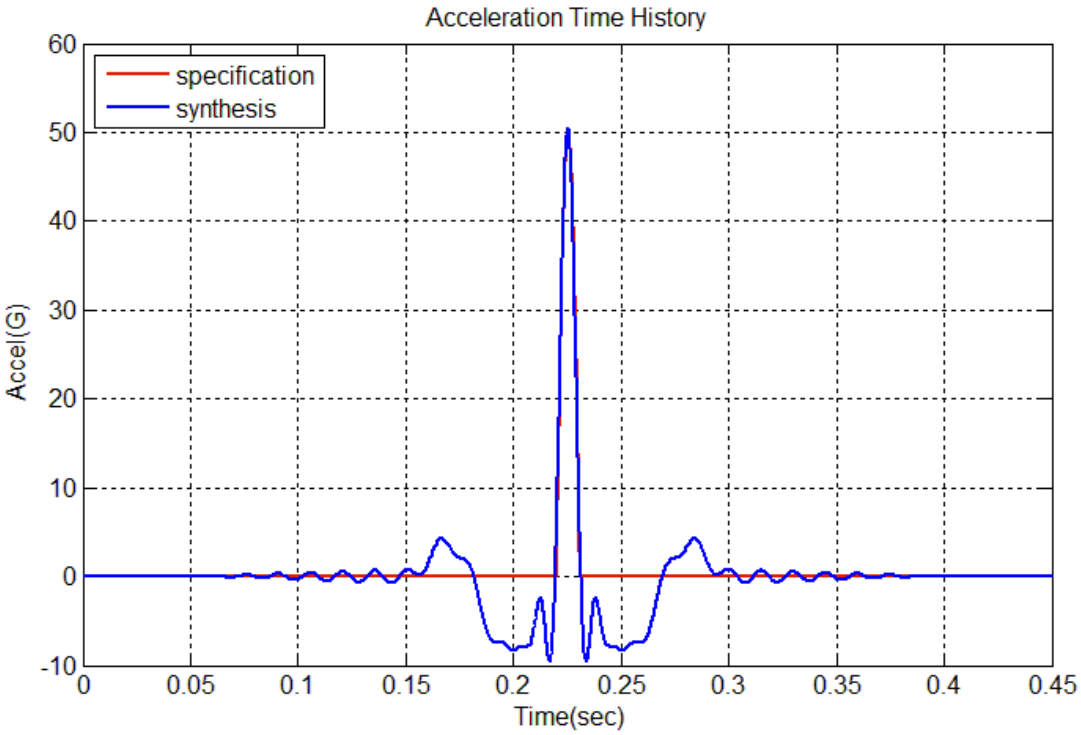

Figure 1.

Again, the specification is a 50 G, 11 millisecond half-sine pulse.

The synthesis is a series of five wavelets.

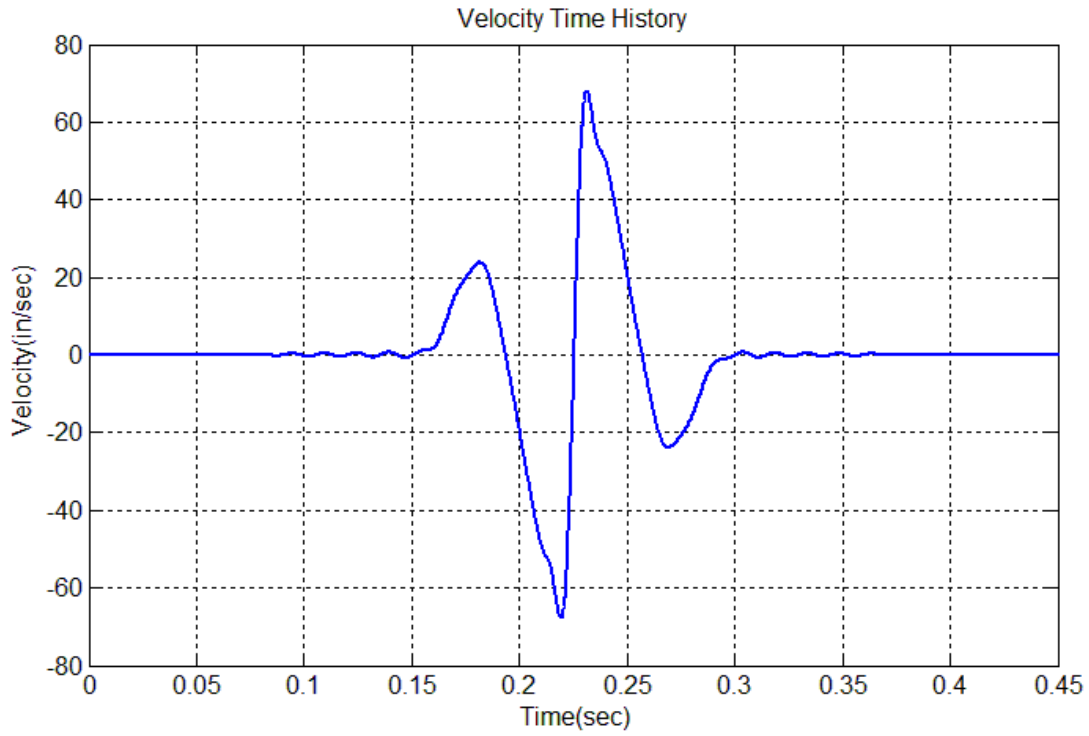

Figure 2.

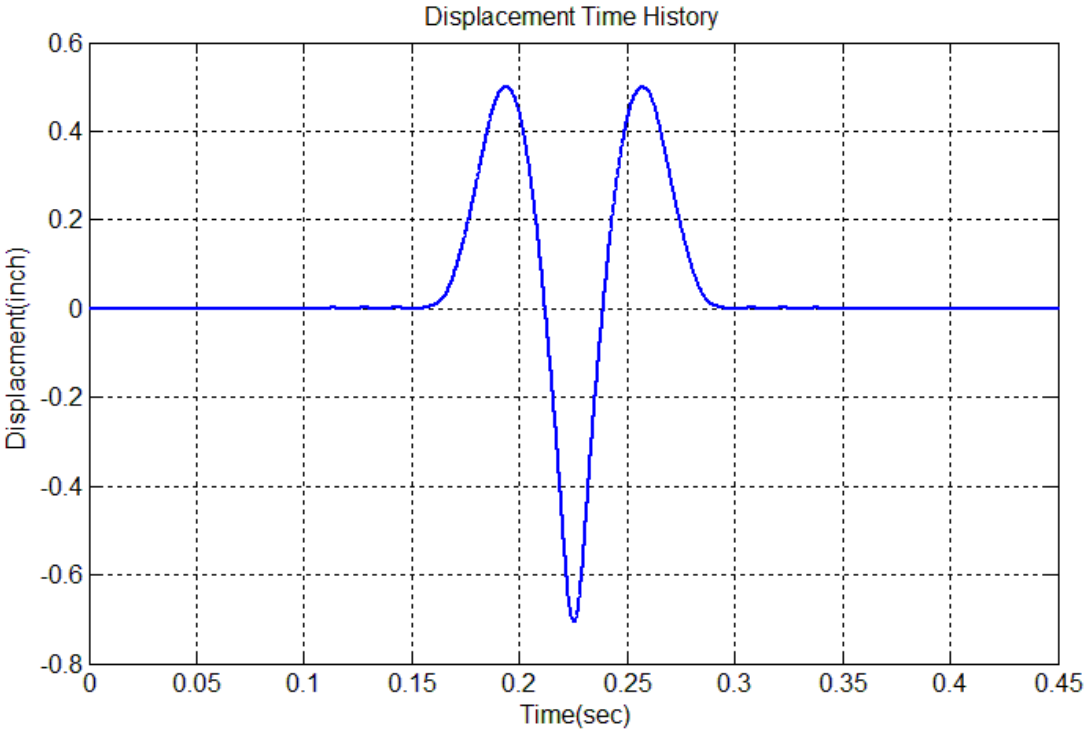

Figure 3.

References

1. T. Irvine, Integrating the Acceleration Half-Sine Pulse, Vibrationdata, 2001.
2. T. Irvine, Waveform Reconstruction using Wavelets, Revision A, Vibrationdata, 2005.