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Development of a Single Input Multiple Output (SIMO) Input Derivation Algorithm for Oscillatory Decaying Shocks

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Abstract

During shaker shock testing of a complex system it may be desirable to match a Shock Response Spectra (SRS) at one location while controlling the test at a different location. Further, it may be desirable to match SRS at multiple locations. This paper builds on an algorithm for deriving an optimum shaker shock input such that a weighted combination of the responses for multiple locations is matched with respect to the field data measured at those locations. Due to the inherent nonlinearities of the SRS, the initial Single Input Multiple Output algorithm (SIMO) was based on David Smallwood's decayed sine synthesis algorithms. Currently, the SIMO algorithm only optimizes the amplitude of the sine tones. This method can result in unrealistic and untestable inputs when the chosen frequencies of the sine tones are close to the transfer function poles or zeros. If the sine tones happen to fall at a transfer function zero where the transfer function very low, the algorithm will derive a high input, with the inverse being true at a transfer function pole. The new algorithm developed in this paper will optimize the frequencies of the sine tones so that they are away from the poles and zeros by a certain amount while retaining a consistent spacing from point to point. This will allow for a more realistic and testable input and more accurate prediction of SRS across multiple datasets.

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