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NONLINEAR SYSTEM IDENTIFICATION OF EXTENSIBLE TRUSS WITH MECHANICAL BACKLASHES

Abstract

The objective of this study is to obtain a systematic way of non-linear system identification methodology to accurately predict the behavior of the extensible truss with mechanical backlashes in multiple nodes. The Hilbert transform is one of the accepted way to evaluate a non-linearity of structure systems. The frequency and amplitude of the mechanical vibration can be analyzed as functions of time.

To analyze the free vibration data, we employ the Hilbert transform to identify a non-linear mathematical model that can express the dynamical characteristics of the extensible trusses. As studied in previous work by Fledman, analytical signal via the Hilbert transform of original free vibration signal measured by a laser displacement sensor can be used to estimate the frequency and amplitude of the vibration. We will extend the work by Fledeman as a systematic way that can be used for multi-degrees-of-freedom (M.D.O.F) non-linear vibration.

First, we studied an existence of the non-linearity between force given to the truss node and its displacement. Then, we observed clear non-linearity of stiffness property with hysteresis behavior. Hence, the transfer characteristics of the truss might have a strong non-linearity. To clarify such a prediction, we then confirmed the variation of the maximum acceleration of the node during free vibration as response to the initial displacement.

Finally, we will find to determine the non-linear transfer function that depends on the vibration amplitude and the amount of backlash at the joints. The results indicate a significant parameters to determine the response to internal disturbance of the extensible truss.