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ACTIVE VIBRATION CONTROL OF SEISMIC-EXCITED CRANE STRUCTURE WITH SELF-TUNING FUZZY LOGIC CONTROLLER

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This paper deals with the active vibration control of container cranes against earthquake excitations. This study aims to reduce the earthquake induced vibrations vibrations of the container crane structures using an active vibration control. Vibration control using intelligent controllers, such as fuzzy logic has attracted the attention of structural control engineers during the last few years, because fuzzy logic can handle, uncertainties and heuristic knowledge and even non-linearities effectively and easily. The improved seismic control performance can be achieved by converting a simply designed static gain into a real time variable dynamic gain through a self-tuning mechanism. For this reason, Self-tuning Fuzzy Logic Controller (STFLC) is designed to reduce the vibrations of the container crane structure. Firstly, a six degrees-of-freedom nonlinear dynamic model of the container crane structure is defined. Then, the STFLC algorithm is developed. Performance of designed controller is evaluated by simulations. In the simulations, the ground motion of the Kobe earthquake (M_w=7.2) in Japan on January 17, 1995 is used as earthquake excitation. The time history of displacements, accelerations, and frequency responses of the both uncontrolled and controlled cases of the crane structure and control force are obtained. Results of this study show that using active vibration control system causes absorption of the destructive effects of high accelerations which occur during the earthquakes. As a conclusion, simulation results exhibit that the implementation of STFLC shows a good response against earthquake.

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