Self-tuning fuzzy logic control of crane structures against earthquake induced vibration

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Received: 30 April 2010 / Accepted: 6 October 2010 / Published online: 4 November 2010
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Abstract Self-tuning fuzzy logic controllers (STFLC) for the active control of Marmara Kocaeli Earthquake excited crane structures are studied in this paper. 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. A self-tuning fuzzy logic controller is designed to reduce the vibrations of the crane structure. The simulated system has a five degrees-of-freedom and modeled system was simulated against the ground motion of the Marmara Kocaeli Earthquake \((M_w = 7.4)\) in Turkey on August 17, 1999. At the end of the study, the time history of the crane bridge and portal legs displacements, accelerations, and frequency responses of the both uncontrolled and controlled cases are presented. Additionally, the performance of the designed STFLC is also compared with a PD controller. Simulations of an earthquake excited bridge and portal legs are performed to prove the validity of proposed control strategy.

Keywords Self-tuning fuzzy logic control · Crane structure · Earthquake-induced vibration