Sajcha Tawaytibhong 2014: Extremum-Seeking Gain-Scheduled Adaptive Input Shaping Applied to Flexible-Link Robot. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Associate Professor Withit Chatlatanagulchai, Ph.D. 50 pages.

Input shaping designs an FIR prefilter. This filter, when convoluted with reference input, produces shaped reference input that avoids resonance, resulting in significantly less residual vibration. A flexible system, when follows this shaped reference input, is able to move from point to point faster due to less settling time. Problem with traditional input shaping is that the filter requires knowledge of system's natural frequencies and damping ratios and hence its performance deteriorates when the system is time varying. This propose a novel adaptive input shaping algorithm. System's natural frequencies and damping ratio are gain-scheduled based on system measured state and are simultaneously adjusted by extremum-seeking for minimum residual vibration. Our algorithm was applied to point to point movement of a flexible-link robot manipulator whose payload varies with time. Experimental results confirm the effectiveness of the proposed algorithm, compared with the unadaptive case.

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