Hardware-in-the-Loop Simulation for Active Force Control with Iterative Learning Applied to an Active Vehicle Suspension System

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ABSTRACT

The paper focuses on the practical implementation of a novel control method to an automotive suspension system using active force control (AFC) with iterative learning algorithm (ILA) and proportional-integral-derivative (PID) control strategy. The overall control system to be known as AFC-IL scheme essentially comprises three feedback control loops to cater for a number of specific tasks, namely, the innermost loop for the force tracking of the pneumatic actuator using PI controller, intermediate loops applying AFC with ILA strategy for the compensation of the disturbances and the outermost loop using PID controller for the computation of the desired force. A number of experiments were carried out on a physical test rig with hardware-in-the-loop simulation (HILS) feature that fully incorporates the theoretical elements. The performance of the proposed control method was evaluated and benchmarked to examine the effectiveness of the system in suppressing the vibration effect of the suspension system. It was found that the experimental results demonstrate the superiority of the active suspension system with proposed AFC-IL scheme compared to the PID and passive counterparts.

KEYWORDS: Active force control; Active suspension; Hardware-in-theloop simulation; Iterative learning algorithm

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