



Article

Multivariable Linear Position Control Based on Active Disturbance Rejection for Two Linear Slides Coupled to a Mass

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Abstract: Active Disturbance Rejection Control (ADRC) is a promising approach that has emerged to deal with uncertainties, which has received many practical applications in motion controls. This paper presents a multivariable controller for active disturbance rejection (ADR) based on an extended state linear observer for tracking the linear position trajectory of a mass moved by two linear slides, each one driven by a DC motor. The linear extended state observer is used to estimate the endogenous and exogenous disturbances of the system, which are assumed to be unknown, but bounded. Therefore, the feedback system prevents each actuator from operating at different forward speeds, and thus a synchronization between the two actuators is achieved by moving the common mass smoothly. The simulation and the experimental results show the effectiveness and robustness of the controller proposal when moving the mass with both actuators.

Keywords: linear multivariable systems; disturbance rejection; observers for linear systems; mechatronic systems; mass driven with two linear slides; position control



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1. Introduction

At present, the use of multivariable control for different linear and non-linear systems of the electrical, electromechanical and renewable energy types has been widely accepted to solve very specific tasks in terms of controlling the physical variables of the system for a desired point or for a desired trajectory; this can be found in different articles previously published in [1–3]. In [1], use is made of the differential flatness property to calculate the desired trajectories of each of the outputs of interest to regulate the non-linear system “double dc/dc converter type reducer coupled to the motor of dc”. In this work, a smooth monitoring of the voltage at the output of the first converter is carried out and at the same time, a smooth monitoring of the angular speed of the motor is carried out. This is achieved by means of a multivariable control based on passivity for the non-linear system proposed.

On the other hand, in [2], a multivariable control by active disturbance rejection is proposed to regulate the angular velocity in the Permanent Magnet Synchronous Motor (PMISM). In this work, they perform a smooth monitoring of the angular speed of the motor and at the same time the current is regulated in its direct component in the d-q coordinates of the non-linear system. Also, it proposes the use of ultra-models that consider the exogenous and endogenous disturbances present in the systems and in combination with a control technique by active rejection of disturbances based on high-gain extended observers for differentially flat nonlinear systems, applied to synchronous motor control [4].

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