Optimal Control of Web Guides Using a New Fiber Optic Edge Sensor

Article

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Abstract

This paper discusses the development of a linear quadratic optimal control algorithm for web guides, and implementation of the control algorithm using web lateral position feedback from a new, experimental fiber optic sensor. The lateral dynamic model of the web and the measurement characteristics of the fiber optic sensor are conducive for a linear quadratic regulator design. The performance of the optimal control algorithm with web lateral position feedback from the fiber optic edge sensor is evaluated by conducting experiments on a web platform. Experiments were also conducted using the same controller but with an existing industrial infrared sensor for web lateral position measurement. Results from a series of comparative experiments indicate that the optimal control algorithm with feedback from the fiber optic sensor provides accurate lateral position regulation in the presence of disturbances, at various web transport speeds, and with web materials with different mechanical, physical and geometric properties. Based on the analysis of the web lateral dynamic model, recommendations for proper guide operation and selection of appropriate web transport conditions for good guiding performance are also discussed.

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