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Design and Development of a web Roll-to-Roll testing system with lateral dynamics control of Displacement guide.

By

Sung-Yu Tsai

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Abstract

Roll-to-Roll (R2R) systems have been widely used in the traditional paper printing and packaging industry. In addition, Roll-to-Roll systems are also considered as a cost effective mass production solution for printed electronics, such as RFID and Solar cells in the recent years [1]. In a Roll-to-Roll system, web material often experiences lateral motion during the transportation to processes [1]. This project presents the lateral dynamics control system integration using centered pivoted displacement guide for Roll-to-Roll application. An initial literature review of the project is carried out with supporting theory and web handling mechanism. The complete system design consists of four units, namely unwinder unit, load cell unit, guide unit and rewinder unit. In this project, two microcontrollers are proposed to control the four units with additional instrumentation and signal conditioning between sensors/actuators, and the controller. The Guide system dynamics are simulated using first order single degree-of-freedom oscillator model controlled with classical PID servo designs. Finally, the complete system is tested with different disturbances input to the system. The system lateral response is compared with and without the guide system. Results are shown to have reduced the lateral motion when media transport speeds are at 20m/min, 40m/min and 60m/min.

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