Modeling Print Registration in Roll-to-Roll Printing Presses

Article

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Abstract

Roll-to-roll (R2R) printing is a continuous process in which thin flexible materials such as paper are passed through a printing press to print the required pattern onto the material. Each printing press may have several printing units depending on the number of colors to be printed and the complexity of the pattern. The flexible material, often referred to as a “web,” is passed successively through each print unit to create a multicolor pattern. Print registration is the process of overlapping successive printed patterns to form a complex multicolor pattern and the registration error is the position misalignment in the overlapped patterns. This paper develops a machine direction print registration model in a printing press with multiple print units whose print cylinders are driven using mechanical line shafts. The registration model considers the effects of interaction between adjacent print units due to variations in material strain and machine dynamics, including various dynamic elements, such as the print cylinder, doctor blade assembly, print unit compensator roller, print unit motor, friction at various locations, etc. Measured data from typical production runs on an industrial printing press are used to corroborate the developed print registration model. Mechanical design and control design recommendations to reduce registration error in print units are also provided. The developed registration model is applicable to many R2R printing technologies, such as offset, flexo, and rotogravure printing.

Link to the Article