Governing Equations for Web Tension and Web Velocity in the Presence of Nonideal Rollers

Article

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Abstract

Since rotating machinery is used to transport flexible materials (commonly known as webs) on rollers, it is common to observe periodic oscillations in measured signals such as web tension and web transport velocity. These periodic oscillations are more prevalent in the presence of nonideal elements such as eccentric rollers and out-of-round material rolls. One of the critical needs in efficient transport of webs is to maintain web tension at a prescribed value. Tension regulation affects almost all key processes involved during web transport including printing, registration, lamination, winding, etc. Governing equations for web tension and transport velocity that can accurately predict measured behavior in the presence of nonideal rollers are beneficial in understanding web transport behavior under various dynamic conditions and the design of suitable web tension and speed control systems. The focus of this paper is on modeling the effect of eccentric rollers and out-of-round material rolls on web tension and web transport velocity. The new governing equations for web velocity on an eccentric roller and web tension in spans adjacent to the eccentric roller are presented and discussed; a web span is the free web between two consecutive rollers. To solve these governing equations, the location of the entry and exit point of the web on the eccentric roller as it rotates and the length of the web spans adjacent to the eccentric roller are required; a procedure for obtaining this information is described. To corroborate the models and the developed approach, data from experiments on a large experimental web platform are compared with data from model simulations, and a representative sample of the results are presented and discussed.

Link to the article