ABSTRACT

Optimal design of the pick-up roller location in the paper feeding device

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Experimental approaches for identifying paper moving behaviors have been studied for several years in the design of paper feeding devices. While Design of Experiment (DOE) method such as Taguchi method has been introduced to reduce the number of experiments, repeated experiments are still required to determine the optimal values in parameters, and interactions between parameters are not considered in the design process.

The main purpose of this study is to introduce a new practical design method based on the numerical simulation to obtain optimal values of the design parameters for paper feeding devices. In this study, finite element analysis of a paper is introduced to determine the location of pick-up rollers in a paper feeding cassette having coupled fingers that are widely used for the paper separation. Reaction forces and stresses at coupled fingers depending on the several different pick-up roller locations and the sizes of a paper are calculated, and the experiments are performed to validate the numerical results.

Based on the comparisons between the numerical simulations and the experiments the optimal pick-up roller locations for both a universal cassette and a single cassette are suggested. The modified design process including the numerical simulations plays an important role in the reduction of the total time required for the design of paper feeding devices. Finally, this study proposed a Moving-Roller Pick-Up System for the universal cassette paper-feeding device, which maintains the same distance between the pick-up roller and coupled fingers regardless of the paper sizes by adjusting the pick-up roller location obtained by the numerical simulation.