Multi-objective design optimization of industrial roll-to-roll systems, using modeFRONTIER

D. Knittel, J. Frechard
University of Strasbourg, Institute of Physics and Engineering
17 rue du Marechal Lefebvre, 67100 Strasbourg, France
and
INSA Strasbourg, Laboratory LGeCo
24 bd de la Victoire, 67084 Strasbourg, France

knittel@unistra.fr

In today industrial context, constraints on manufacturing process are constantly tighter. In order to meet these constraints, performance improvements cannot longer rely only on advanced control techniques or controller design.
Systems handling web material such as textile, paper, polymer or metal are very common in the industry, because they represent a convenient way of transporting and processing a product from one form to another. Printing, coating and drying are examples of operations that can be performed in different sections of a web line. The variables that need to be monitored and controlled in order to achieve the expected product quality and to master the web dynamics are web tensions and speed.
A complex nonlinear roll-to-roll system model has been developed in Matlab/Simulink Software environment. This phenomenological model is used in this study (model based design). This work set up a robust multi-objective design optimization which considers the industrial plant to be designed as a whole and no longer as the sum of its parts. The optimization process using the modeFRONTIER software takes into account the model uncertainties, as for example the web elasticity variations. The parameters to optimize are the controller parameters together with some mechanical variables.