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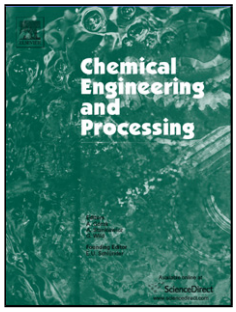

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Optimal Campaigns in End-to-End Continuous Pharmaceuticals Manufacturing. Part 2: Dynamic Optimization

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Abstract

We investigate theoretical optimal campaigns in a continuous process of pharmaceuticals production. The simulated process, inspired by a pilot plant previously tested at MIT, includes several reaction and separation steps to produce final tablets. This paper, demonstrates the use of nonsmooth differential-algebraic equations (DAEs) framework for such optimal campaigns design.

We embed the model developed in the first part of this series in a dynamic optimization problem formulated as a hybrid discrete/continuous and nonsmooth problem. We enforce the quality constraints only on an interior epoch (on-spec) and optimize its duration. We then use a gradient-based optimization tool (IPOPT) to solve the problem. We consider the on-specification productivity over the entire campaign. Various control profiles are chosen as decision variables, as well as the timings of the control switchings. The yield and the productivity of the process are considered as objectives under a constant (short) time

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