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# Maximal Safe Set Computation for Pressure Swing Adsorption Processes

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## Abstract

In this paper we propose a method towards purity control of Pressure Swing Adsorption (PSA) processes which is based on the use of hybrid systems formalism. Hybrid systems feature both continuous and discrete-event dynamics and hence are very suited to describe in detail PSA processes. Based on mechanistic model of the processes, a Local Reduced-Order Model (LROM) is developed for PSA processes. Then the processes are represented as hybrid systems whose continuous evolution is described by the LROM. We then perform an analysis of hybrid reachability properties of the hybrid system obtained, based on which the so-called maximal safe set is computed. The analysis is performed for a two-bed, six-step benchmark PSA process and the influence of the control inputs and external disturbances are investigated.

*Keywords:* Pressure swing adsorption; Hybrid systems; Process control; Maximal safe set; Reachability analysis; Level set methods.

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