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Basic One-Dimensional Modelica®-Model for Simulation of Gas-Phase Adsorber Dynamics

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Abstract : Industrial adsorption processes are, mainly due to si-multaneous heat and mass transfer, characterized by a high level of complexity. The conception of such processes often does not take place systematically; instead scale-up/down respectively number-up/down methods based on existing systems are used. This paper shows how Modelica® can be used to develop a transient model enabling a more systematic design of such ad- and desorption components and processes. The core of this model is a lumped-element submodel of a single adsorbent grain, where the thermodynamic equilibria and the kinetics of the ad- and desorption processes are implemented and solved on the basis of mass-, momentum and energy balances. For validation of this submodel, a fixed bed adsorber, whose characteristics are described in detail in the literature, was modeled and simulated. The simulation results are in good agreement with the experimental results from the literature. Therefore, the model development will be continued, and the extended model will be applied to further adsorber types like rotor adsorbers and moving bed adsorbers.

Keywords : adsorption, desorption, linear driving force, dynamic model, Modelica®, integral equation approach
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