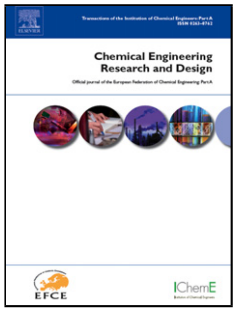

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Shortcut-based optimization of distillation-based processes by a novel reformulation of the feed angle method

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Abstract

The conceptual design of distillation-based separation processes is a well known and thoroughly investigated research subject in chemical engineering science. Nevertheless, there are only few shortcut methods available that are derived without simplifying assumptions, such as constant relative volatilities or constant molar overflow, allowing for a thermodynamically sound evaluation of the minimum energy demand for the separation of non-ideal mixtures. The current article presents a novel reformulation of the previously introduced feed angle method, which represents a geometrical shortcut method that is based on a direct calculation of characteristic pinch points. The reformulation retains the beneficial properties of the original formulation, providing high accuracy and an equation-based formulation that can be embedded in an optimization problem, while being numerically simpler and requiring significantly less case-specific modifications. The benefit of the the so-called FAM+ formulation and the applicability to complex design problems are illustrated on several case studies, including the optimization of a closed-loop flowsheet and a superstructure with two reactors and several distillation columns.

Keywords: distillation, model reduction, shortcut method, feed angle method,

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