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Systematic Process Intensification using Building Blocks

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Abstract

We present a novel method for systematic process design and intensification. We depart from the classical unit operation-based representation of process units, flowsheets and superstructures and propose a new representation using fundamental building blocks. These building blocks can be associated with different process phenomena, tasks and unit operations. An assembly of blocks of the same type obtains a classical unit, while an assembly of blocks with different types results in an intensified unit. This allows to systematically identify and incorporate many intensification pathways using a general block-based superstructure. We design an intensified process by optimizing a performance metric for given raw materials and product specifications, material properties and bounds on flow rates. The overall problem is formulated using a single mixed-integer nonlinear optimization (MINLP) model that can be solved using commercial solvers. We show the applicability of our approach using several design and intensification case studies.

Keywords: Process Intensification, Process Design, Process Synthesis, Optimization, Building Blocks.

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