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On the Optimal Design of Membrane-based Gas Separation Processes

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Abstract

Gas-separation processes are of paramount importance for several industrial applications. In this context, membrane-based gas separation has a great innovation potential in term of limiting the energy consumption and simplifying the process operation and control. Much of the research in this field focused on parametric analyses or optimization procedures aimed at the investigation of some performance indicators, such as separation performance, energy consumption, membrane area. This work aims at developing a comprehensive method which provides criteria for the optimal design and operation of membrane gas separation processes. First, a parametric analysis is carried out, resulting in the definition of attainable regions for different process configurations and product specifications. Subsequently, a multi-objective optimization is carried out by employing a genetic algorithm that minimizes the compression energy and the required membrane area by selecting the optimal process layout, operating variables, and membrane materials.

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