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DISTILLATION COLUMN CONTROLLABILITY ANALYSIS THROUGH HEAT PUMP INTEGRATION

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Highlights

- Distillation-assisted bottom flashing heat pump and vapor recompression heat pump are considered.
- SVD technique used to evaluate controllability properties.
- Seven Controllability indices are determined in steady state condition and frequency domain.
- Using recompression of vapor stream is more useful than liquid stream flashing.
- Replacing the heat inputs corresponding temperatures as manipulated variables show improved controllability indices.

ABSTRACT

Understanding the dynamic behavior of distillation column assisted heat pump has received considerable attention, since this integrated process is used to improve thermodynamic and energy efficiency. This work studied controllability of two processes of distillation column assisted bottom flashing heat pump and vapor recompression heat pump. Integration caused extra degrees of freedom, in which some manipulated-controlled variable pairings were promising. Controllability tools such as set-point tracking and disturbance rejection were applied to compare the input-output pairings and select pairings with the best controllability and disturbance rejection indices under decentralized control in a steady state condition and frequency domain. The results indicated that controllability of recompression of the top vapor stream was better than flashing of the bottom liquid stream of the column. In addition, results showed that reboiler heat duty and reflux rate in a distillation column could be replaced with other variables. Besides, when a heat value was used in a

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