242o Control Structure Synthesis for Reactive Distillation Columns: a Methyl Acetate Case Study

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An approach for the synthesis of effective control structures for reactive distillation columns is demonstrated on an example industrial scale methyl acetate column. The approach consists of identifying the independent regulatory tasks that must be performed to maintain the product purity and reaction conversion in the column. Traditional SISO loops are then implemented for each regulatory task. The input-output (IO) pairing to be used in each loop is obtained by studying the steady-state IO relations to identify pairings that are sensitive, avoid steady-state multiplicities and provide a near linear and large operating window about the base case design. For multiple SISO loops, the Niederlinski Index is used to eliminate dynamically unstable pairings. The steady-state product purity and reaction conversion achieved in the presence of disturbances into a column is used to further eliminate poor control structures. From these purely steady-state analyses, three control structures are synthesized for the example methyl acetate column. Dynamic simulations show that these structures provide effective column regulation for production rate changes and changes in the fresh methanol feed composition.