

557b Evaluation of Criteria for Selecting Temperature Control Trays in Distillation Columns

William L. Luyben

The use of tray temperatures to infer compositions is widespread in distillation control. A number of criteria have been proposed for selecting which trays to hold at constant temperature. The most commonly used are (1) choosing a tray where there are large changes in temperature from tray to tray (“slope” of the temperature profile), (2) finding the tray where there is the largest change in temperature for a change in the manipulated variable (“sensitivity”), (3) using singular value decomposition (SVD) analysis, (4) selecting the tray where the temperature does not change as feed composition changes while producing the desired distillate and bottoms purities and (5) choosing the tray that produces the smallest changes in product purities when it is held constant in the face of feed composition disturbances. This paper provides a quantitative comparison of the effectiveness of these five alternative criteria. Several systems are considered, ranging from ideal binary to azeotropic multi-component. Results show that the SVD method provides the most effective control structure in terms of reducing product quality variability when a variety of feed composition disturbances occur.