Nonlinear Model-based Repetitive Model Predictive Control of SMB Process

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The simulated moving bed (SMB) process, after more than 40years of successful operation in the petrochemical industry, has emerged as one of the most important separation processes in the fields of pharmaceuticals, fine chemicals, and biotechnology, too. However, the optimal operation and automatic control of the SMB process is still a challenging task because of its complex dynamics caused by periodic port switching and inherent nonlinearity.

In this research, a novel advanced control technique for the SMB process has been proposed. In the proposed technique, the purity regulation for both extract and raffinate streams at the terminal time of each period is performed by a nonlinear repetitive controller which utilizes the past cycle data as feedback information. The repetitive controller was designed on the basis of a fundamental nonlinear model of the SMB process. Through application to a numerical SMB process, it was found that the proposed control technique performs quite satisfactorily against model error as well as set point and disturbance changes.