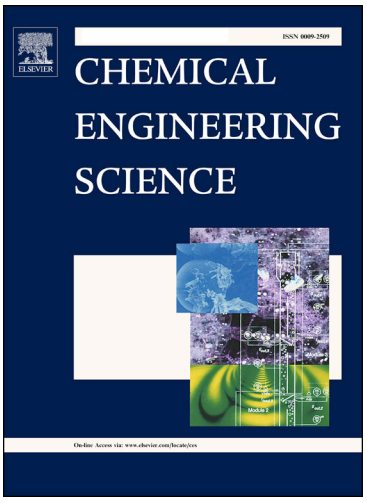

Thermal Stability Criterion Integrated in Model Predictive Control for Batch Reactors

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Thermal Stability Criterion Integrated in Model Predictive Control for Batch Reactors

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Abstract

Thermal runaways can have a significant impact on the performance and normal operation of reaction processes, causing safety issues and financial loss, which hinder the intensification of such processes. More specifically, a control system that does not possess proper detection mechanisms of the boundary of stability will by necessity be overly conservative. This leads to poorer performance and the inability to intensify the process, *i.e.* to reduce process times for example and also to achieve higher yields.

For the intensification of batch processes a stability criterion, based on the divergence criterion, is presented. The derivation of the stability criterion and a comparison to the original divergence criterion is shown for several batch reactions. It is shown that the stability criterion classifies the system behaviour more reliably for the case studies considered. This stability criterion is embedded in Model Predictive Control, which is a novel control scheme. This scheme allows the controlled increase of the reaction temperature while keeping the processes in a stable region, hence reducing the risk of thermal runaways. This control system enables batch processes to achieve a target conversion in a reduced completion time of reaction and an intensification of batch processes.

Keywords: Thermal Stability Criterion, Thermal Runaway Detection, Model Predictive Control, Intensification of Batch Processes

Nomenclature

J Jacobian matrix [-]