Model Predictive Control of Axial Dispersion Tubular Reactors with Recycle: Addressing State-delay through Transport PDEs*

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***Abstract*— This paper presents the model predictive control of an axial tubular reactor with a recycle stream, where the intrinsic time delay imposed by the recycle stream—often overlooked in prior studies—is modeled as a transport PDE. This leads to a boundary-controlled system of coupled parabolic and hyperbolic PDEs under Danckwerts boundary conditions, ideal for this reactor type. A discrete-time linear model predictive controller is designed to stabilize the system. Utilizing Caley-Tustin time discretization along with the late lumping approach, the system's infinite-dimensional characteristics are preserved with no need for model reduction or spatial approximation. Numerical simulations demonstrate the controller's effectiveness in stabilizing an unstable system while satisfying input constraints.**

I. Introduction

This is an example of citing a reference in LaTeX [1].

References

[1] J. Doe and J. Smith, "A comprehensive study on control systems," *IEEE Transactions on Automatic Control*, vol. 69, no. 5, pp. 1234–1245, 2024.

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