## Discrete-time Contraction Constrained Nonlinear Model Predictive Control using Graph-based Geodesic Computation

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## Abstract

Modern chemical processes need to be operated around different operating conditions to optimize plant economy, in response to dynamic supply chains. As such, the process control system needs to handle a wide range of operating conditions whilst optimizing system performance and ensuring stability during transitions. This article presents a reference-flexible nonlinear model predictive control approach using contraction based constraints. Firstly, a contraction condition that ensures convergence to any feasible state trajectories or setpoints is constructed. This condition is then imposed as a constraint on the optimization problem for model predictive control with a general (typically economic) cost function, utilizing Riemannian weighted graphs and shortest path techniques. The result is a reference flexible and fast optimal controller that can trade-off between the rate of target trajectory convergence and economic benefit (away from the desired process objective). The proposed approach is illustrated by a simulation study on a CSTR control problem.

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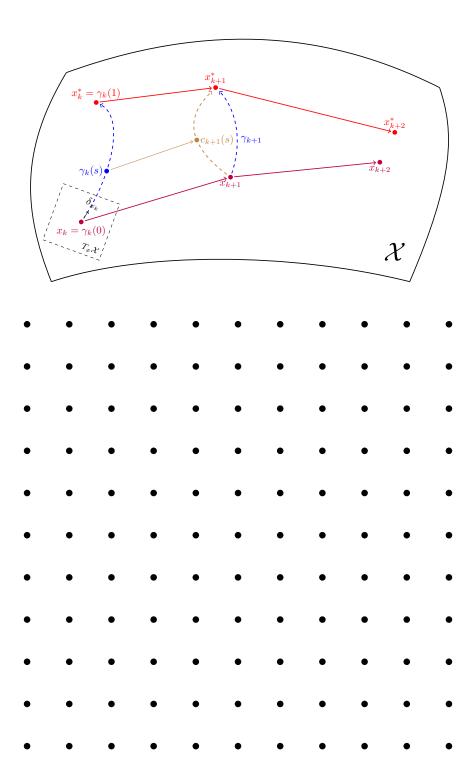
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