# Stabilizing Controllers with Improved Performance for Nonlinear PDEs: a NMPC Approach

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**Abstract:** We present a flexible and general method to ensure the stability of a Model Predictive Control (MPC) scheme applied to several nonlinear partial differential equations (PDEs) with the shortest possible horizon $N = 2$ (known as $instantaneous\ control$). In order to apply the approach developed in [1], we ensure the stability of the MPC by an exponential controllability condition (see [2]), which we deduce from exponential stability estimates given by an explicit feedback controller. In this way, we design an optimal stabilizing control with respect to given cost functionals. We apply the method to several examples, such as the Burgers equation with Neumann boundary conditions, the Korteweg-de Vries-Burgers equation and the Schlögl system. Numerical simulations show the effectiveness of the method and the improved performance in the optimization process. We underline the possibility to apply the same roadmap presented here to a large range of other PDEs, for which the existence of a stabilizing feedback is available. We also find relevant the fact that this approach allows to encompass the presence of state and control constraints in the same setting.

### References

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