Carleman Inequalities and Control of Parabolic equations. Theoretical and Numerical Results

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Abstract

In this talk, we are going to present the numerical computation of null controls for linear Parabolic equations. The goal is to compute approximations of controls that drive the solution from a prescribed initial state to zero at a given positive time. The main idea is to minimize over the class of admissible null controls a functional that involves weighted integrals of the state and the control, with weights that blow up near the final time. In view of the results of Fursikov and Imanuvilov, the associated optimality conditions can be viewed as a differential system in the variables $(\mathbf{x}, t)$ that is second–order in time and fourth–order in space, completed with appropriate boundary conditions. Then, we introduce a finite element approximation of the optimality system that is C^1 in space and we perform some numerical experiments. In order to avoid the use of C^1 finite elements, we present a mixed variational formulation of the problem and, then, appropriate mixed finite element approximations that rely on Lagrangian C^0 spaces and we provide new numerical results.