Department of Mathematics
香港城市大學
City University of Hong Kong

DEPARTMENT OF MATHEMATICS
City University of Hong Kong

Uniform controllability of semidiscrete hyperbolic equations via moment problems

by

Professor Ionel ROVENTA
University of Craiova, Romania

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ABSTRACT

We consider a finite-difference semi-discrete scheme for the approximation of controls of one-dimensional evolution problems of hyperbolic type. In general, the continuous problem is controllable but the high frequency numerical spurious oscillations, introduced by the numerical scheme, lead to a loss of the uniform (with respect to the mesh size) controllability property of the semi-discrete model in the natural setting. For all initial data in the natural energy space, if we filter the high frequencies of these initial data or if we add a numerical vanishing viscosity, we restore the uniform controllability. Moreover, in the case of boundary controls of the wave equation we obtain a relation between the range of filtration and the minimal time of control needed to ensure the uniform controllability property. The main strategy consist of proving the equivalence between a control problem and a problem of moments and constructing explicit solutions to the later problem by using biorthogonal sequences.

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