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**Boundary observability for the space semi-discretizations of the 1-D wave equation.** (English)

Zbl 0947.65101

M2AN, Math. Model. Numer. Anal. 33, No. 2, 407-438 (1999).

The numerical solution of the one-dimensional wave equation with homogeneous Dirichlet boundary conditions is considered especially by both space semi-discretizations: finite difference and finite element methods. The problem of boundary observability, i.e., the problem of whether the total energy of solutions can be estimated uniformly in terms of the energy concentrated on the boundary as the mesh discretization  $h \rightarrow 0$  is investigated. Due to the spurious modes that the numerical scheme introduces at high frequencies, there is no such a uniform bound. A uniform bound is proved in a subspace of solutions generated by the low frequencies of the discrete system. When  $h \rightarrow 0$  these finite-dimensional spaces increase and eventually cover the whole space. Thus the well-known observability property of the continuous system as the limit of discrete observability estimates as the mesh size tends to zero is recovered.

Reviewer: [Angela Handlovičová \(Bratislava\)](#)

**MSC:**

- [65M20](#) Method of lines for initial value and initial-boundary value problems involving PDEs
- [35L05](#) Wave equation
- [93B07](#) Observability
- [65M06](#) Finite difference methods for initial value and initial-boundary value problems involving PDEs
- [65M60](#) Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs

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**Keywords:**

[wave equation](#); [semi-discretization](#); [finite difference](#); [finite element](#); [boundary observability](#)

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