AN ENERGY−CONSERVING DIFFERENCE SCHEME FOR NONLINEAR COUPLED TRANSVERSE/LONGITUDINAL STRING VIBRATION (MonPmOR3)

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Abstract :

In the quest for more realistic string sound synthesis, nonlinear (large−amplitude) effects have recently come under scrutiny. Though a mathematical description of the coupled longitudinal/transverse motion of such a string is straightforward, the development of numerical methods (and thus synthesis algorithms) is complicated due to stability considerations; frequency domain analysis cannot be fruitfully applied when nonlinearities are present. We present here a finite difference scheme for a nonlinear string whose stability can be guaranteed, not through frequency domain analysis, but through an exact discrete energy conservation property. Under certain simple conditions, the so−called energy method leads to bounds on the solution size in terms of initial conditions, and, thus, to a stability guarantee. Implementation details and numerical results are presented.

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