

Energy-Conserving Integration in Six-Field Shell Dynamics

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We propose an energy-conserving time-integration algorithm for dynamics of shell structures. The shell model is based on six-field non-linear theory, with three translations and three rotation parameters describing the shell motion. The spatial approximation is based on the finite element method. The temporal algorithm uses mid-point approximation of the rate equations expressed in state variables. The presence of rotation group in the definition of the configuration space requires special computational techniques. We present numerical simulation of a branched shell moving freely in space, undergoing multiple turns and large relative deformations. The classical extended Newmark integration scheme shows in this case some numerical instability. Application of the energy-conserving scheme gives here comparable results in the period of stable simulation and does not reveal any instability elsewhere. This allows one to extend the simulation period with the use of longer time steps.

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