

Extensions and Benchmark Tests of a Finite Element Solver based on Loop Subdivision Elements

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The thin shell finite element solver of N. Stoop which is based on Loop subdivision elements is extended by a Newmark integration method with adaptive time-stepping and an improved collision handling algorithm. An assessment of the stability and accuracy of the improved solver is performed by a rotation plate and a pinched hemisphere test. They unveil that the present system is reliable and numerically accurate. By a plate at rest it is shown that the free boundary conditions proposed by Cirack et al. are disadvantageous because they violate energy conservation. The improved collision handling algorithm is assessed by two impact tests, one for vertex-triangle and one for edge-edge contacts. It is shown that the improved collision handling algorithm is robust and accurate. The combination of both, the collision handling algorithm and the adaptive time-stepping are capable of handling even highly chaotic systems as those of crumpling membranes.

