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ROBUST INTEGRATION SCHEME FOR SOLVING NONLINEAR DYNAMIC PROBLEMS WITH EXTREMELY LARGE ROTATIONS

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An efficient time-integration algorithm for the nonlinear dynamic analysis of structures is presented. By adopting the temporal discretization for time-finite element approximation, very large time steps can be used by the algorithm. With an accuracy of the fourth order, this technique requires only displacements and velocities to be made available at the start of the current time step for integration in the state space. Using the weighted momentum principle, the problem of discontinuity caused by impulsive loads is resolved after time-integration of the applied load implied by the external momentum. Since no knowledge is required of acceleration at the current time step, the errors caused by estimation of acceleration by previous finite-difference-based methods, including Newmark's β method, are circumvented. Moreover, an iterative procedure is included for each time step, involving the three phases of predictor, corrector, and error-checking. The effectiveness and robustness of the proposed algorithm in solving nonlinear dynamic problems involving extremely large rotations is demonstrated in the numerical examples.

REFERENCES

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