SM17S_10893

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Simulation of Constrained Rigid and Elastic Bodies Without Constraint Equations

Oleg Dmitrochenko[(1)], Dmitry Pogorelov[(1)], Su-Jin Park[(2)], Wan-Suk Yoo[(2)]

(1) *Bryansk State Technical University, Bryansk, Russia*
(2) *Pusan National University, Busan, Korea*

Equations of motion of connected rigid and elastic bodies usually contain an algebraic part for constraint equations (DAE). Although methods of reliable solving DAE are well known, it is worth to avoid them if possible. A rigid body is usually modeled by Newton-Euler equations using any triplet of orientation angles. We consider large displacement finite-element (FE) approaches for simulation of elastic bodies. In the large rotation vector formulation, which uses rotation angles, the generalized coordinates for both rigid and elastic bodies are compatible and we can apply the assembling procedure to obtain ordinary differential equations instead of DAE. The recently introduced absolute nodal coordinate formulation (ANCF) uses finite slopes instead of rotation angles. When a rigid body is attached to ANCF FE without restrictions for relative orientation (revolute joint in 2D, spherical joint in 3D) we still can directly use the assembling procedure. If there are such restrictions we develop new rigid-body elements that employ ANCF nodal slopes as generalized coordinates. These elements can be easily assembled with elastic ones.

View the extended summary