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MULTIBODY SYSTEM DYNAMICS AND NONLINEAR TRANSIENT DYNAMICS WITH FEM: METHODS AND APPLICATIONS

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ABSTRACT

Multibody system dynamics methods are disseminated and widely used in academia and industry. The breadth of applications varies from a solely simple rigid body movement simulation to very complex transient dynamics assessment of full of rigid/flexible bodies, coupled by joints with external actuator loads.

One may find two main approaches towards the simulation of multibody-systems. The first approach is based on numerical integration of the equations of motion of rigid or flexible bodies, by distinct numerous methods. Motion of flexible bodies is often represented by superimposing a rigid body motion and a relative flexible motion in multibody system dynamics. Constraints may be enforced by distinct techniques, such as Lagrange multipliers, penalty methods and Augmented Lagrangian method. Further on, flexibility can be incorporated in a later stage. The second approach is based on application of nonlinear finite element method, where flexibility of bodies is a natural assumption and rigid bodies are particular cases. Then, the techniques used to integrate the resulting differential equations may be distinct from previous approach. Constraints are also enforced by using the previously mentioned techniques.

The objective of this mini-symposium is to provide a forum for discussions of pros/cons of both approaches, of two communities, which are getting closer with advancement of computational resources: multibody and nonlinear FEM transient dynamics.

The mini-symposium aims to focus on dynamic problems involving rigid and flexible bodies in contact. The topics of interest include (but are not limited to)

- Time-integration of multibody dynamics equations
- Time-integration of nonlinear transient dynamics FEM equations
- Modeling of rigid/flexible bodies in multibody dynamics environments
- Modeling or rigid/flexible bodies in nonlinear transient dynamics FEM environments
- Joints
- Holonomic/non-holonomic constraints and modeling
- Geometrically-exact finite elements applied for multibody dynamics simulations
- Contact between bodies in multibody dynamics

The mini-symposium encourages works presenting results using methods beyond those found directly in commercial software. Also of interest are works that propose numerical methods and ideas that can facilitate model reduction in contact problems.