

A COMPARISON BETWEEN DIFFERENT APPROACHES TO MODEL MULTIBODY SYSTEMS WITH CONTACT

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The importance of providing real-time and accurate prediction of the dynamics of multi-body systems for robotics missions as well as physics based engines have motivated many researchers to investigate different modeling approaches for multibody systems with contact.

There are several approaches to model a multi-body system with contact, proposed in the literature. In this paper a comparison between the complementarity formulation and the Prox method is presented. In the complementarity approach the system model can be composed of either the exact friction cone which yields a nonlinear complementarity problem or an approximation of the friction cone as a pyramid, which simplifies the problem to a linear complementarity problem. The linear complementarity problem can be solved using pivotal algorithms such as Lemke algorithm.

In the Prox formulation the exact friction cone is considered. After formulating the problem using the Prox approach, the problem can be solved either by using the fixed point iterations or using the root finding techniques. One of the key parameters in the Prox method, which has a significant effect on the convergence of the method is the regularization factor. The optimal choice of the regularization factor is discussed in this paper.

There are pros and cons associated with each of the aforementioned approaches. In this paper these techniques are compared using two numerical examples. The key features of the comparison are the convergence of different techniques as well as their accuracy and efficiency.