Friedrich-Alexander-Universität
Erlangen-Nürnberg

Seminar für Fragen der Mechanik

zu folgendem Vortrag wird herzlich eingeladen

Montag, 01.12.2008, 14:30 Uhr, Egerlandstr. 5, Raum 0.044

Discrete mechanics and optimal control of multibody dynamics

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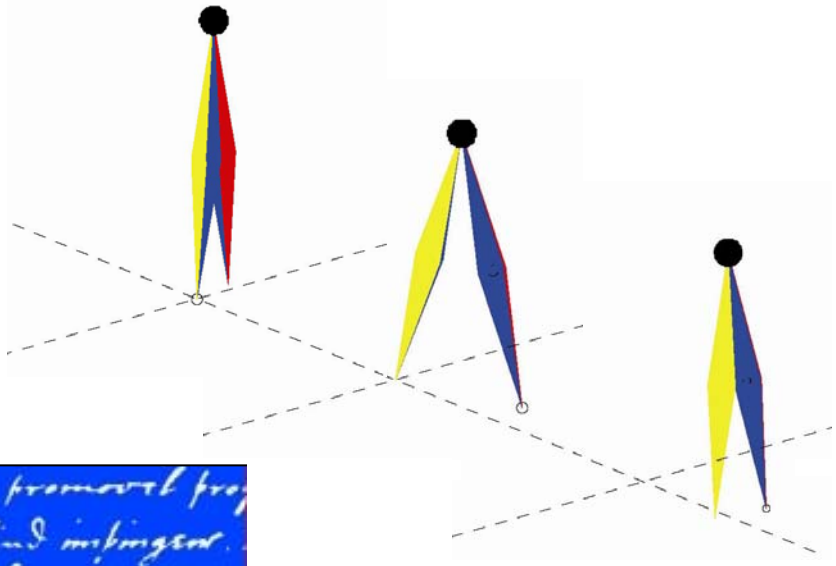
The benefits of structure preserving algorithms for the numerical time-integration of mechanical systems, also called mechanical integrators, are widely accepted in forward dynamic simulations. On the one hand, the fidelity of the approximate solution is improved compared to standard methods by inheriting certain characteristic properties of the continuous motion to the discrete trajectory. For example, the evolution of the system's energy or momentum maps exactly represents externally applied forces, in particular they are conserved along the approximate motion of unforced systems. Furthermore, the symplectic structure underlying real dynamics is respected by certain mechanical integrators. On the other hand, the preservation of these quantities stabilises the numerical integration and thus enables longterm simulation.

However, in the field of motion planning and optimal control via direct methods, so far, these benefits have been less used. The dynamic optimisation method DMOC (Discrete Mechanics and Optimal Control) presented in this talk, does exploit the structure preserving properties of a variational integrator within an optimal control problem.

In the presented work, DMOCC (Discrete Mechanics and Optimal Control for Constrained Systems) is applied to the optimal control of multibody dynamics, where the interconnections between different rigid or elastic structures are modelled as holonomic constraints. The algorithm yields a sequence of optimal discrete configurations together with a sequence of optimal actuating forces. The method is applied to a satellite reorientation manoeuvre, a biomotion problem and a three-dimensional compass biped walker.



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