



McMaster University



University of Toronto



University of Waterloo

## THE FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES

### GEOMETRIC MECHANICS SEMINARS

**SPEAKER:**

**MICHAEL J. ENOS**  
The Fields Institute

On the Topic:

### "On the Controllability and Time-Optimal Control of a Nonholonomic Mechanical System with Drift"

We consider the motions of a system of two coupled rigid bodies, consisting of an asymmetric rigid body (or 'carrier') which we identify with  $A \in SO(3)$  and an axisymmetric body (or 'rotor') constrained to rotate with its axis of symmetry coincident with a principal inertial axis of the first body. It is assumed that the position of the rotor relative to the carrier can be controlled exactly and that there are no external forces on the system, so that its total angular momentum is a constant (and generally nonzero) vector  $\mu$  throughout any motion.

We will investigate the notion of constructive controllability of this system, in the following sense: Given a set of endpoints for  $A$  in  $SO(3)$  and a given vector  $\mu$ , is it possible to construct a motion of this system (preferably *explicitly* and of a simple form) on an interval  $[0, T]$  with angular momentum  $\mu$  and for which  $A$  has these endpoints? We will give a complete answer to this question (and more).

Time-permitting we will also discuss the complete solution of the time-optimal control problem with this system over absolutely continuous motions with fixed-endpoint motions for  $A$  in  $SO(3)$  (and more).

**Thursday, June 10, 1993**

**3:30 pm, room 3013**

**at**

**The Fields Institute**

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