

2nd Seminar on Mechanical Science and Bioengineering
Graduate School of Engineering Science, Osaka University
Lecture Room A403
10:30- 12:00, Monday, June 5, 2006

Muscle Recruitment in Inverse Dynamics-based Musculoskeletal Simulation

John Rasmussen
Associate Professor
The AnyBody Group
Department of Mechanical Engineering
Aalborg University
Denmark

Musculoskeletal simulation basically falls into the two categories of forward and inverse dynamics. Forward dynamics involves the solution of a computationally costly optimum control problem and inverse dynamics is therefore currently the only way to perform musculoskeletal analysis of models with realistic complexity.

Inverse dynamics is haunted by the so-called redundancy problem, which in an engineering context is equivalent to statical indeterminacy: The number of available equilibrium conditions is less than the number of unknown muscle and joint forces. This means that infinitely many different combinations of muscle forces will balance the system, and the human central nervous system instantly chooses one of them when performing a movement. To perform inverse dynamics mathematical algorithms must mimic this choice.

This presentation shows how a minimum fatigue criterion can be implemented into software extremely efficiently and how it is ideal for musculoskeletal models for investigation of problems in ergonomics and orthopedic surgery.

