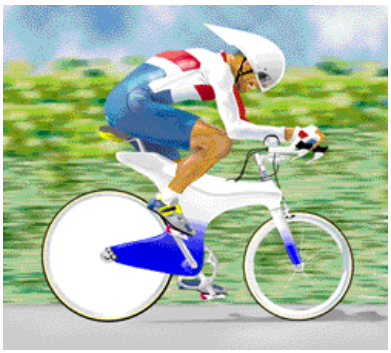
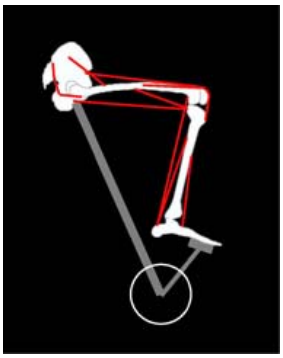
MECHANICS COLLOQUIUM



Tuesday, Oct 12, 2004
15:45-16:45 h.
Delft University of Technology
Mechanical Engineering
Mekelweg 2, Delft
Room E



Biomechanics of Pedaling

Simulation Studies on the Relation between Mechanical Power Output and Kinematical Constraints on Leg Motion

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Abstract - In order to address questions concerning the coordination of pedaling on a bicycle, we coupled a forward dynamical model of the rider to a reduced model of the bicycle. In the model used, the leg of the rider, consisting of upper leg, lower leg and foot, has one degree of freedom; crank angle does not fully specify leg position. In the context of such a model, the timing of the stimulation of each muscle group can be optimized with respect to the power output (the average mechanical power delivered to the crank). After showing that the optimal solution adequately describes experimental data, we consider the effects of kinematical constraints on leg motion. First we consider the question how power output is affected when the leg is forced to move just like it does in the optimal solution and the muscle stimulation is re-optimized. Next we consider a clinically relevant question related to pedaling by paraplegic subjects on the basis of functional electrical stimulation; here the question is how power output is affected when the external fixation of the ankle joint that is normally present is removed and ankle muscles are stimulated.

References

Soest, A.J. van and Casius, L.J.R. (2000) Which factors determine the optimal pedaling rate in sprint cycling? Med. Sci. Sports Exerc. 32, 1927-1934.

Soest, A.J. van, Gfoehler, M. and Casius, L.J.R. (2004) Consequences of ankle joint fixation on FES cycling power output; a simulation study. Med. Sci. Sports Exerc., submitted.

About the speaker - Dr A. J. van Soest, better known as Knoek van Soest, is a faculty staff member at the Faculty of Human Movement Sciences, Free University Amsterdam, and a member of the Institute of Fundamental and Clinical Human Movement Sciences, Amsterdam/Nijmegen. His research interests are musculoskeletal mechanics and energetics, control and coordination of complex human movements, and modeling/simulation/optimization tools to address these issues.