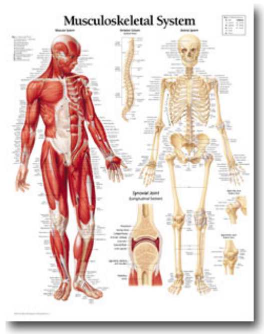
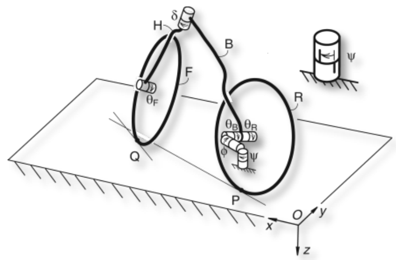
MSc.Assigment	A musculoskeletal bicycle rider model.



+



=

Keywords	Bicycle, Dynamics, Biomechanics, Control.
Introduction	With the Whipple model of the uncontrolled bicycle now well established [1] the question remains how do people control the mostly laterally unstable bicycle? One promising direction is adding a minimal musculoskeletal[2] rider model to the Whipple model. With this rider model one could drive and stabilize the bicycle. [1] J. P. Meijaard, Jim M. Papadopoulos, Andy Ruina, A. L. Schwab, 2007 Linearized dynamics equations for the balance and steer of a bicycle: a benchmark and review, *Proceedings of the Royal Society A* 463:1955-1982. [2] 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.
Project	Add a minimal (few extra degrees of freedom) musculoskeletal model to the Whipple bicycle model and add a control strategy such that the bicycle is laterally stabilized and driven by the pedal forces resulting from muscle forces. Investigate the robustness of the control by adding longitudinal and lateral perturbations (a hill and side wind). Think of a way to quantify the handling quality by f.i. looking at the control effort.
Project phases	The candidate will start by studying the literature on bicycle dynamics, and musculoskeletal models. Next, the two models will be incorporated into one model. Various control strategies will be explored.

Supervisor Name	Department	Email
Arend L. Schwab	PME/Engineering Dynamics Faculty 3mE Delft University of Technology	a.l.schwab@tudelft.nl 06 2852 7539
Knoek van Soest	Faculty Human Movement Sciences VU Amsterdam	a.j.van.soest@vu.nl 020 59 88606