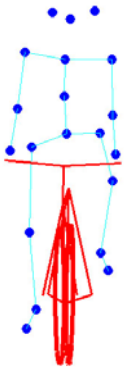
MECHANICS COLLOQUIUM

Thursday, 4 June 2009,
12:45-13:30 h.
Delft University of Technology
Faculty of Mechanical Engineering
Room D



"First Look at Rider Biomechanics while Controlling a Bicycle"

Jason K. Moore
Sports Biomechanics Laboratory
Department of Mechanical and Aeronautical Engineering
University of California, Davis, California 95616, USA
email: jkmoor@ucdavis.edu

Abstract - Bicycling is such an everyday thing for most people. Its simplicity and elegant form conceal the fact that it takes more than turning a steering wheel in the desired direction to keep the two-wheeled vehicle upright and going along the intended course. But yet a bicyclist does this unconsciously. Is it simply the rider's faith that prevents gravity from dragging this inverse pendulum vehicle to the ground or is it a phenomenon that can be explained by the laws of physics?

A bicycle is one of the few regularly used vehicles in which the person is more massive than the vehicle and the rider's passive motions have to constantly be attended to by the person's inner control system. There are many anecdotal theories on how a person moves to keep a bicycling upright. Is it all through the steering, does the bicycle stay upright on its on, does the rider lean or twist, etc? The answers to these questions still have little scientific backing. Sound conclusions to these questions will lead us to understanding the depths of the human control system and how we are able to interact with complex dynamical systems.

I will present some of the findings of the past year's work in the TU Delft Bicycle Dynamics lab. We have developed an instrumented bicycle capable of measuring the vehicle dynamics and visually recording the rider motions and used it for on-road and treadmill rider observation. These studies shed light on the use of steering control, pedaling influence, and body motions. We then used full motion capture to quantify these results. Data from the motion capture experiments showed how the pedaling dynamics were linked to other body motions and which motions were potential stabilizing control actions.

About the speaker – Jason Moore is a visiting researcher from the United States through the US Fulbright Program. He received his bachelor's degree in Mechanical Engineering from Old Dominion University (2004) and Master's Degree in Mechanical and Aeronautical Engineering from the University of California at Davis (2007) where is continuing on a PhD track in the Sports Biomechanics Lab under the tutelage of Mont Hubbard. He has worked on various mechanical design projects from balance design at one of the world's largest wind tunnels to biomedical test equipment design for cell shear theory. But it is his desire to spread the virtues of bicycling that continue to influence his engineering path. He is a minister at the Davis Bike Church where he teaches people how to repair their bicycles and his research has taken him around the world from India to Africa to Latin America and now to the Netherlands where bicycles out number the people. He hopes he can share the Netherlands elegant use of bicycles for utility with the world. http://mae.ucdavis.edu/~biosport/jkm/