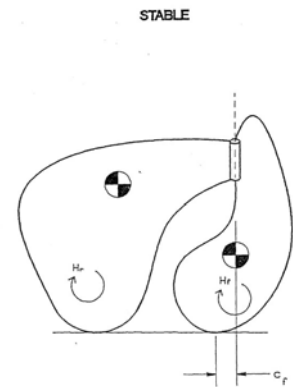


MECHANICS COLLOQUIUM



Friday, Oct 3, 2008
11:00-12:00 h.

Delft University of Technology
Faculty 3mE/Mech. Eng.
Mekelweg 2, Delft
Room E



On Bicycle Handling and Self-Stability

Jim M. Papadopoulos

Green Bay, WI, USA

Abstract – The talk starts with a short discussion of what it might mean to ‘understand’ the behavior of bicycles. Correct mechanics analysis of reasonable models may be necessary, but clearly is not sufficient. Even if we temporarily ignore the severe problems caused by inclusion of a realistic rider, it may be said that simple aspects of bicycle dynamics, such as stability, are not at all explained.

Next a brief review will be presented on widespread ideas about bicycle and motorcycle stability. Necessary distinctions of the various potential meanings of ‘stability’ will be made, including riderless, open loop with a flexible rider, control by a flexible no-hands rider, and control by a hands-on rider. Standard ideas about trail, gyroscopic effects, and rear-wheel steering will be explained clearly.

The core of the talk is a description of various attempts to understand riderless (or, no-hands rigid-rider) stability of a somewhat idealized but experimentally supported bicycle model. This will largely be via analytical exploration of the open-loop eigenvalue structure, backed up by numerical validation of analyses. Some quite general results will be presented, along with counterexamples to the usual ideas.

Some time will be devoted to an important counterexample, which has recently been demonstrated experimentally by the Delft bicycle research group.

About the speaker – Jim Papadopoulos earned his Bachelor’s degree (1979) in Mechanical Engineering at MIT, with a focus on Mechanics of Materials; and his Master’s degree (1982) from Johns Hopkins, where he studied Continuum Mechanics with Ericksen and Truesdell. He completed his Ph.D. (1986) in Mechanical Engineering at MIT on deformation theorems for random assemblies of frictionless spheres. At the same time he was running a laboratory devoted to the simulation of underground fracturing, as used by the Petroleum Industry.

His academic career started in 1986 with a post-doc in the lab of Andy Ruina, at Cornell, where they initiated the Cornell Bicycle Research Project. This was an underfunded program in which many topics were initiated and few were finished. The presentation today may be considered an outgrowth of that work.

After academic positions at Cornell and Northern Illinois University, Jim gained his Professional Engineer license and took up industrial work at various firms in Wisconsin: Rexnord, Paper Converting Machine Company and FEECO.

Jim has 8 patents and is co-author of *Bicycling Science* (MIT Press).

Local host – [Arend L. Schwab](#).