

MECHANICS COLLOQUIUM

in combination with

DCSC COLLOQUIUM



Wednesday, June 9, 2004,
11:00-12:00 h.
Delft University of Technology
Mechanical Engineering
Mekelweg 2, Delft
Room D



“Bicycle Dynamics and Control”

Karl J. Åström,

Department of Automatic Control,
Lund Institute of Technology,
Lund, Sweden.

Abstract - Many issues of dynamics and control can be illustrated by bicycles. Bicycles are very nice from the educational point of view because practically all students are familiar with them. Many interesting and thought provoking experiments can also be performed using bicycles. Issues related to dynamics and control such as stabilization and co-design of process and controllers can be illustrated very well. Bicycles can also be used to practically demonstrate the importance of abstract notions such as zeros and non-minimum phase behavior. The lecture gives some experiences of using bicycles in control education. Simple mathematical models that capture the essence of bicycle dynamics behavior will be derived and used to discuss issues of dynamics and control. It can be shown that a bicycle is self stabilizing if it is driven fast. Stabilization of the bicycle introduces a right half plane zero in the steering dynamics. This is responsible for many motorcycle accidents. The zero will disappear if an additional control variable (leaning) is used. Bicycles with rear wheel steering are also discussed. It is shown that such bicycles are inherently difficult to ride. Experiences from building a number of bicycles and using them in teaching is also presented.

About the speaker - <http://www.control.lth.se/~kja/> Karl Johan Åström was educated at the Royal Institute of Technology, Stockholm, Sweden where he got his MS '57 and PhD '60. In 1965 he was appointed Professor to the Chair of Automatic Control at Lund Institute of Technology/Lund University, Lund, Sweden, where he built a new department from scratch. Since 2000, he has been Professor Emeritus at Lund University and part-time Professor in Mechanical and Engineering at the University of California, Santa Barbara. He has broad interests in automatic control, including stochastic control, system identification, adaptive control, computer control, and computer-aided control engineering. He has received many honors, among them the Quazza Medal from the International Federation of Automatic Control (IFAC), the IEEE Field Award in Control Systems Science, and the IEEE Medal of Honor.

