



DEPARTMENT OF MECHANICAL ENGINEERING Purdue School of Engineering and Technology

FALL 2005 SEMINAR SERIES

Date: **Friday, October 7, 2005**

Time: **11:00 am - 12:00 pm**

Room: **SL 165**

**Reception at 10:45 am (cookies and refreshments served)
Everyone is invited**

Modeling, Control, and Validation of an Electro-Hydraulic Steer-By-Wire System for Articulated Vehicle Applications

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Abstract. X-by-wire control systems in automotive applications refer to systems where the input device used by the operator is connected to the actuation power subsystem by electrical wires as opposed to being connected by mechanical or hydraulic means. The 'X' in the X-by-wire is replaced by 'steer', 'throttle', 'brake' to represent the steer-by-wire, throttle-by-wire and brake-by-wire systems. Common to all of these subsystems is that the operator control input device (i.e. steering column, acceleration pedal, brake pedal) is not connected to the actuation devices mechanically. Rather, it is connected to an embedded computer which in turn sends the control signals to the actuation devices.

Current state of art steering systems used in articulated vehicles are hydro-mechanical type systems. That is the steering column motion is transmitted and amplified by the main hydraulic circuit by hydro-mechanical means. This paper presents a new steer-by-wire system which we designed, modeled, analyzed, and tested on a wheel type loader construction equipment. The simulation results and tests conducted on a prototype development vehicle (a medium size wheel type loader) show very good agreement. Control algorithm and the vehicle dynamics are modeled using graphical modeling tools similar to Simulink and StateFlow. Real-time control algorithm is implemented on a Motorola 68332 microprocessor based embedded controller. The operational performance of the steer-by-wire system has been convincingly demonstrated. We will also give an overview of the research activities of our lab.

About the Speaker. Dr. Sabri Cetinkunt is a Professor of Mechanical Engineering at the University of Illinois at Chicago. He is the director of Manufacturing Research Center. He is the founder and chief technology officer of Servo Tech Inc, a start-up high tech company specialized in computer controlled motion systems.

He received B.S. degree in Aerospace Engineering from Technical University of Istanbul in 1982, M.S. and Ph.D. degrees in Mechanical Engineering from Georgia Institute of Technology in 1984 and 1987, respectively. His research interests include mechatronics, motion control, servo control systems, high speed automated machine design, robotics, nano positioners, precision systems, electro-hydraulic control & applications in earth moving equipment technology, expert systems, neural networks, real time systems. He has written over 50 technical papers, authored a book titled Mechatronics by John Wiley & Sons, and holds four US patents in electrohydraulic control systems area.