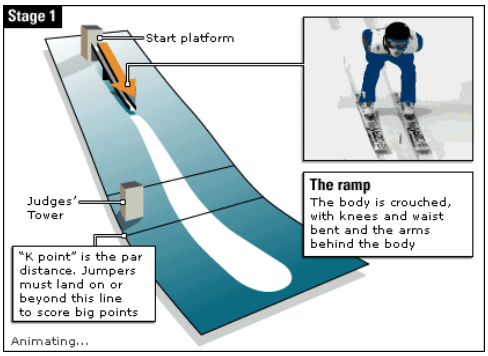
MECHANICS COLLOQUIUM



Wednesday, May 28, 2008
13:30-14:30 h.

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

Safe Ski Jump Landing Slope Design

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Abstract – Skiing has evolved to become more acrobatic, with the use of terrain park jumps and other features playing a prominent role in an increase in serious spinal cord injuries. Yet these jumps are rarely, if ever, designed or engineered. This paper presents a coherent methodology for the design of ski jump landing surfaces. Landing impact severity is characterized by skier velocity perpendicular to the slope V_p or, more understandably, equivalent fall height (EFH). The requirement that EFH be small is satisfied by making the landing surface slope nearly equal to the skier flight path slope at landing. Safe landing surfaces are shown to satisfy a first order ordinary differential equation (ode). Having chosen an EFH deemed safe enough, integration of this ode provides members of an infinite family of landing surfaces that limit the EFH to the desired value, for *any* jumper in-run velocity. Using the takeoff ramp angle as a design variable, it is possible to choose one member of this family to fit on almost any available jump site. The formulation incorporates the fact that skiers can modify velocity direction and magnitude at takeoff by jumping. Such "safe" surfaces can still yield exhilarating flight experiences with relatively long flight times and large air height above the surface before landing, but without the danger posed by jumps created in an *ad hoc* manner.

About the speaker – Mont Hubbard received the B.S. degree in Engineering Science from the U.S. Military Academy, West Point, NY, in 1964, the M.S. in Mechanical Engineering from the Massachusetts Institute of Technology, Cambridge, MA in 1965, and the Ph.D. in Aeronautics and Astronautics from Stanford University, Palo Alto, CA in 1975. Since 1974, he has been a Professor in the Department of Mechanical and Aeronautical Engineering, at the University of California, Davis. His research includes applications of modeling, estimation and control in mechanical and biomechanical systems. A special research interest is sport mechanics and optimization. Professor Hubbard has been supported by the U.S. Olympic Committee with grants for the study of javelin throwing, ski jumping and the dynamics of the bobsled. He is the author of 150 papers including more than 50 in the area of sports mechanics and biomechanics.

Local host – Arend L. Schwab.