

DEPARTMENT OF MECHANICAL ENGINEERING

SEMINAR SERIES



A New Reduced-Gravity Physical Simulation Technology for Potential Space and Medical Applications

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Abstract: Each manned space exploration mission requires a significant amount of microgravity (0-G) or reduced-gravity (reduced-G) simulation for astronauts to practice all the planned space tasks and for system/operation engineers to verify all the operational requirements. Research of many scientific questions regarding natural human behavior in reduced-G environment also requires extensive support of ground-based reduced-G physical simulations. The currently available reduced-gravity simulation technologies such as the parabolic flight and neutral buoyancy facilities are very expensive and difficult to access. Thus, effective and low-cost reduced-G simulation technologies need to be developed. This presentation introduces a novel reduced-G (including 0-G) simulation technology and equipment system for simulating human activities in any desired gravity level (from 0 to 100% G). Developed based on spring-based static balancing technology, the simulation system has many degrees of freedom to allow an attached human to comfortably perform physical activities such as walking and climbing while biomechanically feeling no or less gravity force. The system is passive during simulation and thus, is intrinsically stable, safe and inexpensive. It also has an active function for adjusting the system for different individuals and for different gravity levels. Dr. Ma's research group has done extensive dynamics analysis of the technology and also built a prototype of the system to demonstrate the feasibility of the technology. A potential application of the technology for locomotion rehabilitation will also be discussed.

Biography: Ou Ma received a B.Sc. degree from Zhejiang University (China) in 1982 and a M.Eng and Ph.D. degrees from McGill University, in 1987 and 1991, respectively. He is currently an endowed chair professor in the Department of Mechanical and Aerospace Engineering, New Mexico State University (NMSU). His research areas are system dynamics, manipulator control and biomechanics mainly for aerospace and healthcare applications. Prior to joining NMSU in 2002, Dr. Ma had worked in MDA Space Missions (previously called MD Robotics) for over 11 years as a project engineer and R&D technical lead for a number of major projects developing space robotics technologies for the Space Shuttle and the International Space Station programs. He had also participated in several concept design and evaluation projects for satellite on-orbit servicing missions including DARPA's Orbital Express and Germany's DEOS programs.

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McGill