Seminar Announcement / NTUST ME Department

Variable payload balancing

Just Herder

Full Professor, Delft University of Technology, Netherlands
Full Professor, University of Twente, Netherlands

09:30 AM Wednesday 30 October 2013 @ Room IB-201 (2nd floor, International Building)

Summary:

In current mechanisms and robotics science there is a trend towards more simplicity and robustness, while maintaining or even improving performance. A promising approach to meeting these apparently conflicting demands is self-adaptability. This talk will first touch an example of such mechanisms, namely underactuation in robotic graspers, and proceed in more depth to energy-free adjustment of gravity balancers to variable payload, and dynamic balancing of manipulators for high speed and high accuracy, also considering variable payload.

Underactuated graspers employ the fact that they have less actuators than degrees of freedom by self-adapting to any object that is being grasped. The talk will discuss several new topologies, their behaviour, and their analysis based on energy methods.

Static balancing is a well-known technique to reduce actuator torques in mechanisms and machines that suffer from counteraction by conservative forces, such as gravity. Robots and many other devices can save considerable energy by applying countermasses or springs. In case of variable payload, these countermasses or springs will ideally self-adjust. One complication is that in general energy is needed for this adjustment. The talk will present various methods to eliminate energy consumption for adjustment. Examples will be given and a successful start-up company based on this technology will be discussed.

Dynamic balancing aims at eliminating all base reaction forces of a manipulator due to the fast motion of its members. In many cases, cycle times are longer than necessary because of waiting for vibrations to die out, that would otherwise introduce errors in pick and place. This talk will discuss recent methods for the design of high-speed dynamically balanced mechanisms, present experimental evaluations, and discuss limits to the ability to consider variable payload.

Biography:

Prof. dr. ir. Just L. Herder received his M.Sc. in 1992 and his Ph.D. in 2001, both with honors (cum laude), in Mechanical Engineering from Delft University of Technology. Currently he is a part-time (0.8 FTE) Full Professor of Interactive Mechanisms and Mechatronics at the Department of Precision and Microsystems Engineering at Delft and a part-time (0.2 FTE) Full Professor of Design of Mechanisms and Robotics at University of Twente. He recently obtained a Fulbright Visiting Scholar grant for a 6 months sabbatical at MIT, PERG laboratory.

Herder is Editor-in-Chief of the open access journal Mechanical Sciences, and associate editor for IFToMM Mechanism and Machine Theory as well as for ASME Journal of Medical Devices. He served as board member in five international conferences, and as program committee member in over a dozen more. He was elected as a member of the ASME Mechanisms and Robotics Committee and is currently an elected member of the Executive Council and Treasurer of the International Federation for the Promotion of Mechanism and Machine Science (IFToMM).

He is a recipient of various international awards, including the 2001 ASME/GM Young Investigator Award and the 2009 ASME IDETC Best Paper Award, has published over 130 peer-reviewed full papers in scientific journals and conferences, while over a dozen of his patents have entered the international phase. He is teaching a variety of undergraduate and graduate courses, and has advised well over 100 M.Sc. graduate students and a dozen Ph.D. students. Six active start-up companies have emerged from his research.