

# Distinguished Seminar in Robotics, Systems & Control

The Institute of Robotics and Intelligent Systems presents:

## Robotic Augmentation of Human Locomotor Capabilities

**Date:** May 3, 2019

**Time:** 15.15

**Place:** HG G3

### Abstract:

Wearable robotics promise the tantalizing potential to enable paralyzed individuals to walk again, or to make able-bodied users stronger or faster. Yet, only in science fiction movies do people actually move around naturally in robotic suits; the conventional approach has left us with cumbersome prototypes that are rather used for training than for functional benefit. Delivering real-life solutions requires tackling the underlying engineering bottlenecks, as well as tight and early collaboration with users and healthcare professionals, to continuously guide and align technological development. This talk will advocate complementary designs that increase usability and functional benefit, by avoiding overlap of hardware or control with an individual's remaining human motor function. Following this paradigm, designs may emerge that bear little resemblance to today's exoskeletons or robotic suits. For example, in an individual who only needs balance assistance, supporting trunk orientation may be less obtrusive and still more functional than supporting the legs. Technically, this can be enabled in a wearable fashion by gyroscopic actuators, hidden in inconspicuous backpacks, that appear to connect the user to a fixed frame in the air. For any application, complementarity especially requires scrutinizing the need for actuation or energy supply, often enabling much lighter and cheaper solutions. Diverse examples will be provided, from prosthetics for elderly amputees to next-generation gait training environments, and experimental results of individuals with orthopedic or neurological impairments will be presented.

### Biography:

Heike Vallery received her Dipl.-Ing. degree in Mechanical Engineering (with honors) from RWTH Aachen University in 2004. Since then, she has been working on robot-assisted rehabilitation and prosthetic legs, in close collaboration with clinical partners and experts in neuroscience and biomechanics. She received her Dr.-Ing. from the Technische Universität München in 2009. From 2008 to 2011, she worked as a postdoctoral fellow at the SMS Lab at ETH Zürich. At that time, she and her collaborators started realizing diverse transparent robotic interfaces for 3D overground gait training, which are now enabling ground-breaking research on recovery after spinal cord injury. From 2011 to 2012, she worked at Khalifa University in Abu Dhabi as an assistant professor, and she joined TU Delft in 2012 in that same function. Today, as a full professor at TU Delft, she works on minimalistic and unconventional concepts to support human gait and balance. Heike Vallery has published more than 70 peer-reviewed publications, filed 11 patent applications, and received diverse fellowships and awards, such as the 1st prize of the euRobotics Technology Transfer Award 2014 and a Vidi fellowship in 2016 from the Netherlands Organisation for Scientific Research.

