MECHANICAL ENGINEERING SEMINAR

"How Robots Can Outperform Conventional Rehabilitation"

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Abstract: Stroke affects more than one million people in the EU and more than 700.000 in the U.S. each year. Furthermore, there are approximately half a million new cases of spinal cord injuries (SCI) all over the world every year. During conventional (i.e. manual) training, the intensity of functional therapy appears to be inadequate. Treatment duration is so short that hospitalized patients are inactive for more than 90% of the day. Outpatients receive even less treatment. The low incidence of therapy might be explained by health-economic arguments, but it is elusive from a pure clinical or therapeutic point of view: it has been clearly shown that greater intensity of training leads to a better therapeutic outcome and a reduction of impairment level. It is also well known that infants and little children are active during the majority of their waking hours and even partly during sleep in order to learn walking and grasping movements in an effective manner. Robot-assisted arm and gait training can increase the duration and number of training sessions as well as the number of movement repetitions per session (training intensity). Furthermore, robotic systems enable repetitive training, increase patient motivation and provide quantitative measures supporting the assessment of the rehabilitation progress. In the last years, several studies have shown that robot-aided rehabilitation has the potential to outperform conventional therapies: robots do lead to more effective and more efficient neurorehabilitative training results, when being applied in an intensive and patient-cooperative way. The challenge of future rehabilitation will be to identify those „responders" that show a good effect on the therapy, provide an individual prognosis an adapt the training paradigms to the individual patient in such way that the training outcome can be maximised. This talk will present some examples of novel robotic systems that can improve the effect of neurorehabilitation training in stroke and SCI patients.

Bio: Robert Riener studied Mechanical Engineering at TU München, Germany, and University of Maryland, USA. He received a Dr.-Ing. degree in Engineering from the TU München in 1997. After postdoctoral work from 1998-1999 at the Centro di Bioingegneria, Politecnico di Milano, he returned to TU München, where he completed his Habilitation in the field of Biomechatronics in 2003. In 2003 he became assistant professor at ETH Zurich and Spinal Cord Injury Center of the University Hospital Balgrist ("double-professorship"); since 2010 he has been full professor for Sensory-Motor Systems, ETH Zurich. Since 2012, Riener belongs to the Department of Health Sciences and Technology, which he is chairing as head since 2016. Riener has published more than 400 peer-reviewed journal and conference articles, 20 books and book chapters and filed 20 patents. He has received 18 personal distinctions and awards including the Swiss Technology Award in 2006, the IEEE TNSRE Best Paper Award 2010, and the euRobotics Technology Transfer Awards 2011 and 2012. Riener's research focuses on the investigation of the sensory-motor interactions between humans and machines. This includes the development of user-cooperative robotic devices and virtual reality technologies applied to neurorehabilitation. Riener is the initiator and organizer of the Cybathlon 2016.

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