



TÜBINGEN'S EXCELLENCE:
DRIVING PERSONALISED MEDICINE &
MEDICAL TECHNOLOGY

The ZPM would like to invite you to a seminar talk given by **Dr. Metin Sitti** from the Physical Intelligence Department of the Max Planck Institute for Intelligent Systems in Stuttgart about the **clinical application of miniature mobile robots** from pill-size down to micron scale.

Title

"Medical Mobile Robots From Pill-size Down to Micron Scale"

Date

Wednesday 06.07.2016
04:30 pm

Place

Klinken Berg, Conference Center
(Building 520), Room 1 (level 1)
Otfried-Müller-Straße 6, 72076 Tübingen

Abstract

Miniature mobile robots have the unique capability of accessing to small spaces inside the unprecedented regions of the human body with minimal invasion. In this presentation, design and control of different size scale untethered miniature robots towards medical or bioengineering use are presented. First, pill-size untethered soft capsule robots are proposed to enable minimally invasive medical diagnosis and advanced therapeutic functions inside stomach. The magnetically actuated soft capsule endoscope is rolled on the stomach tissue surface using the torque exerted by an external permanent magnet to control the capsule's position and orientation. Preliminary active imaging, local drug delivery, biopsy and elastography functions of the proposed capsule robot are demonstrated. Next, going down to sub-millimeter size mobile robots for future potential medical applications such as targeted drug delivery, bacteria attached to micro-robot body are used to propel such swimming micro-robots in liquid. As preliminary results, magnetic, pH-tactic and chemotactic steering of *S. marcescens* bacteria attached micro-swimmers are demonstrated. Finally, external actuation of untethered magnetic micro-robots could enable new medical or bioengineering applications using remote magnetic fields in micro-fluidic channels or inside the human body. New magnetic micro-robot locomotion principles on surfaces and inside liquids are proposed. Such untethered micro-robot teams are demonstrated to control microfluidic flow locally and manipulate cells or cell-laden micro-gels with or without contact inside microfluidic channels.

Dr. Metin Sitti



Metin Sitti received the BSc and MSc degrees in electrical and electronics engineering from Bogazici University, Istanbul, Turkey, in 1992 and 1994, respectively, and the PhD degree in electrical engineering from the University of Tokyo, Tokyo, Japan, in 1999. He was a research scientist at UC Berkeley during 1999-2002. He is currently a director of the Physical Intelligence Department at the Max-Planck Institute for Intelligent Systems, Stuttgart, Germany and a professor in Department of Mechanical Engineering at Carnegie Mellon University, Pittsburgh, PA, USA. His research interests include physical intelligence, medical milli/micro-robots, novel micro/nano-materials, bio-inspired robots, and soft robots. He is an IEEE Fellow. He received the IBM Smarter Planet Award in 2012, the SPIE Nanoengineering Pioneer Award in 2011, and NSF CAREER Award in 2005. He received the IEEE/ASME Best Mechatronics Paper Award in 2014, the Best Poster Award in the Adhesion Conference in 2014, the Best Paper Award in the IEEE/RSJ International Conference on Intelligent Robots and Systems in 2009 and 1998, the first prize in the World RoboCup Micro-Robotics Competition in 2012 and 2013, the Best Biomimetics Paper Award in the IEEE Robotics and Biomimetics Conference in 2004, and the Best Video Award in the IEEE Robotics and Automation Conference in 2002. He is the editor-in-chief of Journal of Micro-Bio Robotics.



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