

Kolloquium

Am Freitag, dem 22. November 2013, um 14:00 Uhr hält

Prof. Dr. Antoine Ferreira
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einen Vortrag mit dem Titel

Modeling and Control Challenges in Medical Nanorobotics

Der Vortrag findet im OFFIS, Escherweg 2, Konferenzraum F02 statt.

Zusammenfassung:

This talk presents the first steps of modeling, control and development of drug delivery microrobotic systems (consisting of nanoActuators and nanoSensors) for the propulsion and navigation of ferromagnetic microcapsules in the cardiovascular system controlled by a clinical Magnetic Resonance Imaging (MRI). Engineered micro-/nano-devices may be successful vehicles for transporting, delivering and targeting drugs. The integration of ferromagnetic particles allows potential MR-tracking and automatic delivery of the biocarriers through induced forces generated by magnetic gradients. MRI systems offer a level of flexibility, provide concentration and tracking information, real-time interventional capabilities and are already widespread in hospitals. Control schemes for automatic delivery of these biocarriers to specific regions of the tumor through the lymphatic vessels are presented for early cancer diagnostics.

In this presentation we present first, the nanocapsule design constituted of molecular elements that can function as sensors, actuators, drug delivery mechanisms; magnetic components for achieving navigation inside the human body and carbon nanotube-based nanostructures. Second, we present computational studies on controlled navigable micro/nanocapsules which are steered by magnetic gradients generated by the MRI system. The navigation modeling was studied for future development of nanocapsules designed to perform minimally invasive interventions in remote sites accessible through the human cardiovascular system (from aorta-to-capillary networks). Third, different modeling methodologies and simulations have been developed for robust control in-vivo navigation in the cardiovascular system. Finally, some micro/nanofabrication technologies (magnetic carbon nanotube-based nanocapsules and novel polymer micelle nanocarrier, based on water soluble amphiphilic block copolymers) are presented.

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Gastgeber: Prof. Dr. Sergej Fatikow