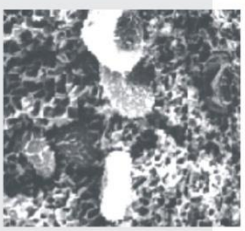
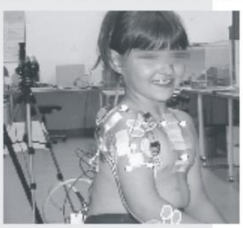
Kolloquium

Biomedizinische Technik und verwandte Gebiete

Wintersemester 2016/17

Donnerstag, 24.11.2016, 17:00 - 18:30 Uhr





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„Hardware-in-the-Loop Testing of Biomedical Implants“

Abstract:

Increasingly sophisticated biomedical implants and the growing demand for evidence during the admission of new devices lead to extensive testing under complex dynamic and reproducible conditions. This calls for test environments that can mimic physiologic and pathologic behaviors in vitro.

The hardware-in-the-loop (HIL) principle combines a simulation of the relevant physiology with in-vitro testing of the actual device. Devices to be tested are connected to interfaces that provide the dynamic conditions needed in the respective application. For instance, ventriculoperitoneal (VP) shunts to treat hydrocephalus or ventricular assist devices (VADs) to support patients with heart failure are connected to pressure tanks that either simulate the intracranial and intraperitoneal pressure (SmartShunt test bench) or the left ventricular and aortic pressure (hybrid mock circulation), respectively. Pressure levels are computed with the help of the respective mathematical model and set according to the measured flow rate through the VP shunt or the VAD. For the VP shunt, the position of the test bench - simulating the patient’s posture – is an additional variable in the pressure calculation.

Simulations on the SmartShunt test bench of a 24-h test cycle that was based on recordings of a patient with a VP shunt showed good agreement with published data on pressure levels and flow rates during typical daily activities. New developed physiological controllers for VADs based on left ventricular volume or pressure were tested effectively on the hybrid mock circulation.

HIL testing proves to be an efficient tool to test medical devices and their controllers under realistic and reproducible conditions, improve the understanding of complex interactions between patient and device and reduce in vivo experiments at the same time.

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