



1 Concept of pulse wave velocity measurement system

2 Sensor samples for proof of principle

## IMPLANTABLE HEMODYNAMIC SENSOR

### Background

Coronary heart disease is the most frequent cause of death in developed countries. It is often induced by narrowing of blood vessels through plaque deposition (stenosis), which is usually treated by implantation of a stent, i.e. a tubular structure that is inserted with a catheter to support the vessel from the inside. This technique extended the life expectancy of many patients, but still is not without risks: Many patients (20-30%) develop a re-narrowing of the vessel in the stent (restenosis), which is often detected late, with the means of diagnosis being complex and hence executed in large time intervals.

The grade of restenosis can be determined by observing the time the pulse wave (an elastic wave that travels over the blood vessel with every heart stroke) needs to travel through the stent. Fraunhofer IPA developed an implantable wireless system that can measure the pulse wave velocity within a stent, that only needs a few passive components to be integrated.

### Technical description

Two tank circuits, each consisting of a capacitive pressure sensor and a coil, are integrated at each end of the stent. They act as wireless transponders with a resonance frequency that depends on the pressure. They are excited with an external magnetic field of a specific frequency. When the pulse wave passes, the tank circuits are in resonance with the field for a short instant of time. The resonance can be detected with an external circuit. From the time sequence of resonances, the pulse wave velocity can be obtained.

### Our competences

- The team at Fraunhofer IPA can provide:
- Design, mathematical modelling (analytical, FEA) and optimization of microelectromechanical systems (MEMS)
  - Realization of MEMS with partners
  - Development of implantable microsystems
  - Circuit design and manufacturing
  - Signal analyses

### Project Group for Automation in Medicine and Biotechnology

Theodor-Kutzer-Ufer 1-3 | House 8  
68167 Mannheim | Germany

### Contact

Dipl.-Ing. Jonathan Schächtele  
Phone: +49 (0) 621 17207 153  
jonathan.schaechtele@ipa.fraunhofer.de

<http://pamb.ipa.fraunhofer.de>