Antenna Stents for Pressure and Flow Monitoring

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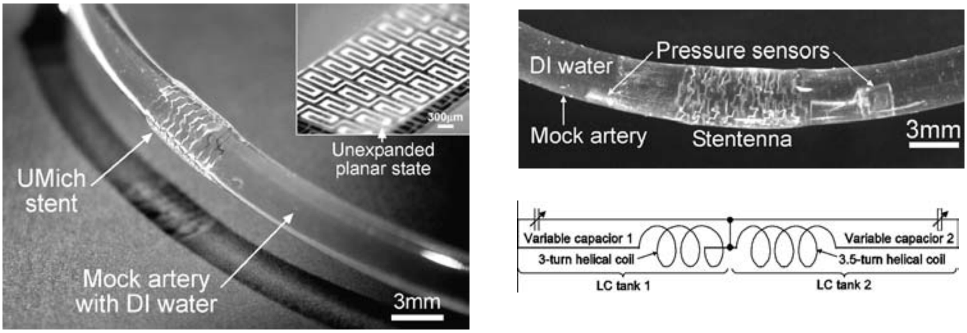

Left – A UMich stent expanded from a planar structure to a tubular shape inside a 3-mm i.d. silicone mock artery using an angioplasty balloon. Right – A dual-inductor stentenna with two pressure sensors and its equivalent circuit.

This project investigates stents that exploit planar microfabrication technologies and their applications to wireless sensing of blood pressure and flow rate. To date, stents have found the greatest use in fighting coronary artery disease. A stent typically has mesh-like walls in a tubular shape, and once positioned by a catheter, is expanded radially by the inflation of an angioplasty balloon. Its primary task is to physically expand and scaffold blood vessels that have been narrowed by plaque accumulation. Although the vast majority of commercialized stents are made by laser machining of stainless steel tubes, this approach offers limited throughput. A breakthrough approach for batch-compatible micro-electro-discharge machining (μEDM) now permits high throughput patterning of microstructures in any metal. It has been applied to manufacture stents that demonstrate better mechanical performance than some commercial products. This effort is being further extended to develop an antenna stent, or stentenna, and to integrate it with microsensors. Wireless monitoring of a micromachined pressure sensor has been successfully demonstrated. A dual-inductor stentenna integrated with two pressure sensors is being developed for wireless flow-rate sensing in an artery. In addition, electromagnetic flow sensing methods are also being explored. This project is supported in part by an NSF grant on plasma and discharge-based manufacturing, and in part by the Riethmuller Fellowship.