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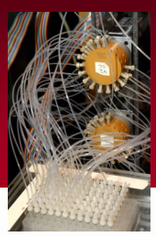
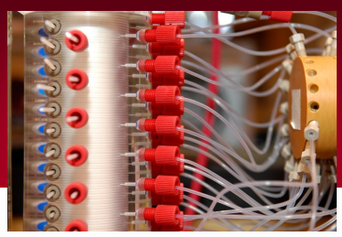


The Gene and Linda Voiland School of

Chemical Engineering and Bioengineering

2014 Seminar Series
Monday, September 15, 2014
12:00 p.m. CUE 319

Tutku Karacolak
Assistant Professor
School of Engineering and Computer Science,
Washington State University Vancouver

Tutka Karacolak received his B.Sc. degree in electrical and electronics engineering from Bilkent University, Turkey in 2004, his M.Sc. And Ph.D. In electrical engineering from Mississippi State University (MSU) in 2006 and 2009, respectively. From 2010 to July 2011, he was a post-doctoral associate in electrical engineering at MSU. In August 2011, he joined Washington State University Vancouver where he is currently an assistant professor. His research interests are bioelectromagnetics, implantable antennas, antenna miniaturization, ultra wide band antennas, and silicon carbide antennas. Dr. Karacolak is a member of IEEE and Eta Kappa Nu, and was the recipient of 2008 IEEE Antennas and Propagation Society Graduate Scholarship and 2009 MSU Research Assistant of the Year Award.

Implantable Antennas for Long Term Medical Wireless Telemetry

Recent advances in electrical engineering have let the realization of small size electrical systems for in-body applications. Today's hybrid implantable systems combine radio frequency and biosensor technologies. The biosensors are intended for wireless medical monitoring of the physiological parameters such as glucose, pressure, temperature, etc. Enabling wireless communication with these biosensors is vital to allow continuous monitoring of the patients over a distance via radio frequency (RF) technology. Because the implantable antennas provide communication between the implanted device and the external environment, their efficient design is vital for overall system reliability. However, antenna design for implantable RF systems is a quite challenging problem due to antenna miniaturization, biocompatibility with the body's physiology, high losses in the tissue, impedance matching, and low-power requirements.

In this talk, design and measurement techniques of implantable antennas for medical wireless telemetry are presented. The antenna geometric parameters are optimized using a robust stochastic evolutionary optimization method, particle swarm optimization, combined with electromagnetics numerical simulation tools. In order to test the designed antennas, *in vitro* and *in vivo* measurement techniques are introduced. Materials mimicking the electrical properties of biological tissues are developed, and the optimized antennas are measured in the materials. Moreover, antennas are *in vivo* tested to observe the effects of the live tissue on the antenna performance using animal models (rats and pigs). Simulation and measurement results regarding antenna parameters are discussed in detail.