



“Addressing the Needs of Emerging Surgical Paradigms Using Intelligent Surgical Robots and Complementary Situational Awareness”

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Abstract: In the past two decades surgical robots have been used as tools that augment human dexterity and manipulation capabilities. Our research goal at the Advanced Robotics and Mechanism Applications (ARMA) laboratory is to extend this concept of augmenting user skill to include assistance in sensing, sub-task execution, and situational awareness within the context of surgery. Motivating surgical applications from the areas of cochlear implant surgery, retinal micro-surgery, minimally invasive, less invasive & natural orifice surgery will be presented. Within the context of these surgical applications, we will focus on our efforts in modeling, designing and controlling intelligent surgical robots capable of sensing the environment and using the sensed information for task execution assistance. The talk will describe recent results on the design and control of continuum robots capable of performing contact detection and localization of contact. A modeling approach for compliant motion control of continuum robots will be presented along with clinical motivation from the area of minimally invasive surgery of the upper airways and trans-urethral resection of bladder cancer. Time permitting; we will also describe assistive telemanipulation frameworks for micro-stent deployment and for cochlear implant electrode array insertion.



•**Biosketch:** Dr. **Nabil Simaan** received his Ph.D. in mechanical engineering from the *Technion—Israel Institute of Technology*, in 2002. His Masters and Ph.D. research focused on the design, synthesis, and singularity analysis of parallel robots for medical applications, stiffness synthesis and modulation for parallel robots with actuation and kinematic redundancies. His graduate advisor was Dr. Moshe Shoham. In 2003, he was a Postdoctoral Research Scientist at Johns Hopkins University National Science Foundation (NSF) *Engineering Research Center for Computer-Integrated Surgical Systems and Technology (ERC-CISST)*, where he focused on minimally invasive robotic assistance in confined spaces under the supervision of Dr. Russell H. Taylor. In 2005, he joined Columbia University, New York, NY, as an Assistant Professor of mechanical engineering and the Director of the *Advanced Robotics and Mechanisms Applications (ARMA) Laboratory*. In 2009 he received the NSF Career award for young investigators to design new algorithms and robots for safe interaction with the anatomy. He was promoted to Associate Professor in 2010 and he subsequently joined Vanderbilt University. He is a Senior Member of the IEEE. He serves as an Editor for IEEE International Conference on Robotics and Automation (ICRA), Associate Editor for *IEEE Transactions on Robotics* (TRO), Editorial board member of *Robotica*, Area Chair for Robotics Science and Systems (2014, 2015) and Corresponding Co-Chair for the IEEE Technical Committee on Surgical Robotics.

Date: Friday, September 18th 2015

Time: 11:00AM – 12:00NOON

Location: 227 Mudd