

ELECTRICAL & COMPUTER ENGINEERING SEMINAR

“Size Matters! A Miniature Robot for Urban Search and Rescue”

by

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LSC Room 213-5

Abstract & Biography

Abstract. Size matters for many robotic applications. Large size may be required for great reach or mass, for example, while small size may be required to access confined spaces or for stealth. I am particularly interested in small robots for access to confined spaces for urban search and rescue. This is important as small size results in severe constraints on resources and drives the need for miniaturization.

The bulk of this talk focuses on work supporting the TerminatorBot (a.k.a. CRAWLER - a Cylindrical Robot for Autonomous Walking and Lifting during Emergency Response). The talk begins with a brief description of CRAWLER, itself. A soda can-size robot with dual-use limbs for locomotion and manipulation, CRAWLER's two, three-degree-of-freedom limbs can manipulate small objects with a pinch grasp, or drag the body of the robot along rubbled terrain. In its locomotion modes, the weight of the body is supported by its environment much like a cold-blooded reptile. The talk continues with a description of a novel metric for classifying terrain based on "gait bounce". Gait bounce is the vertical motion of objects in the visual scene resulting from the cyclic motions of the limb gaits. Gait bounce can be measured naturally by visual servoing errors with no additional sensors. From the gait bounce signature, the immediate terrain beneath the robot can be classified for self-adaptation or other needs. Self-adaptation is important for this robot due to its complexity. The human/computer interface can overwhelm typical field operatives. Therefore, we are developing a novel "wearable joystick" for commanding the robot in gloves-on hazardous environments. Based on these needs for motion control and computer vision, preliminary work on a single-chip, embedded, multiprocessor system for real-time control and self-adaptation of the hardware/software system will be described.

Biography. Dr. Voyles received the B.S. in Electrical Engineering from Purdue University in 1983, the M.S. in Manufacturing Systems Engineering from the Department of Mechanical Engineering at Stanford University in 1989, and the Ph.D. in Robotics from the School of Computer Science at Carnegie Mellon University in 1997. He is currently an Associate Professor in the Department of Electrical and Computer Engineering at the University of Denver and a Senior Member of the IEEE. He was at the University of Minnesota from 1997 to 2006 where he co-founded the NSF Safety, Security, and Rescue Research Center, an NSF I/UCRC, at the University of Minnesota. Dr. Voyles' research interests are in the areas of robotics and artificial intelligence. Specifically, he is interested in the development of small, resource-constrained robots and robot teams for urban search and rescue and surveillance. Dr. Voyles has additional expertise in sensors and sensor calibration, particularly haptic and force sensors, and real-time control. Dr. Voyles' industrial experience includes Dart Controls, IBM Corp., Intergrated Systems, Inc., and Avanti Optics. He has also served on the boards of various start-ups and non-profit groups.

Please contact Prof. Anthony Maciejewski, aam@colostate.edu, with any questions.