

The Department of Electrical and Computer Engineering at Colorado State University is pleased to present a seminar by

**Dr. Anthony A. (Tony) Maciejewski, Professor and Head  
Electrical and Computer Engineering Department, Colorado State University**

**Title: "Kinematically redundant robots - The promise of human-like dexterity"**

**Monday, January 22, from 4:10 to 5:10pm, Engineering Building, Room D102**

**Abstract:** The vast majority of robots in use today operate in very structured environments, e.g., in factory assembly lines, and possess only those limited motion capabilities required to perform specific tasks. While these robots can outperform humans in terms of speed, strength, and accuracy for these tasks, they are no match for the dexterity of human motion. Part of a human's inherent advantage over industrial robots is due to the large number of degrees of freedom in the human body. Articulated, i.e., jointed, motion systems that possess more degrees of freedom than the minimum required to perform a specified task are referred to as kinematically redundant. In an effort to mimic the dexterity of biological systems, researchers have built a number of kinematically redundant robotic systems, e.g., anthropomorphic arms, multi-fingered hands, dual-arm manipulators, and walking machines. While these systems vary in their appearance and intended applications, they all require motion control strategies that coordinate large numbers of joints to achieve the high degree of dexterity possible with redundant systems. This talk will discuss the issues that arise when designing such strategies, frequently drawing on the use of the singular value decomposition, including the characterization of redundancy, the quantification of dexterity, and the development of efficient and numerically stable motion control algorithms that simultaneously optimize multiple criteria. In addition, the ability of kinematically redundant robots to sustain component failures and yet still complete an assigned task will be addressed, thereby extending the application of robots to environments that are unacceptable or inaccessible to humans.

Refreshments will be served.

Please contact Prof. Branislav Notaros, [notaros@colostate.edu](mailto:notaros@colostate.edu), with any questions.

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**Short Bio:** Tony Maciejewski received the PhD degree in Electrical Engineering from The Ohio State University and served on the faculty at Purdue University for 14 years. He is currently the Head of Electrical and Computer Engineering at Colorado State University. He is a Fellow of the IEEE for his contributions to the design and control of kinematically redundant robots.