

RESEARCH INTERESTS

Dr. Sobh's current research interests include robots and electromechanical systems prototyping, sensor-based distributed control schemes, reverse engineering and industrial inspection, CAD/CAM and active sensing under uncertainty, unifying tolerances across sensing, design, and manufacturing, online engineering, hybrid and discrete event control, modeling, and applications, mobile robotic manipulation and engineering education. He is also interested in developing theoretical and modular tools to aid performing adaptive goal-directed robotic sensing for modeling, observing and controlling interactive agents in unstructured environments.

SAMPLE OF CURRENT AND PAST RESEARCH PROJECTS

Current Research Projects

- On-Line Virtual Real-Time E-Collaboration
- Data Envelopment Analysis Approach for Efficient Engineering Enrollment Management
- A New Algorithm for Measuring and Optimizing the Manipulability Index
- Mobile Manipulation Platforms
- A Framework for Extreme Modular Design: A Plug and Play Approach to Sensory Modules, Actuation Platforms, and Task Descriptions and Implementations for Robotics and Automation
- The robotic musicians band project (Partially Artificial Musicians (PAM)) with the School of Arts and Sciences.
- The chiropractic force sensor project (The Glove) and business plan with the School of Chiropractic and the School of Business.
- The electronic educational assessment web-based system with the School of Education.
- 3-D Reverse Engineering applications in dentistry, entertainment, plastic surgery and movie making (with the Health Sciences Division, the School of Arts and Sciences, and the School of Business).
- Ergonomically-correct task-based design of cockpit interiors based on manipulability measures (Dept. of Industrial design, Dept. of Mathematics, Dept. of Mechanical Engineering and the Dept. of Computer Science and Engineering).
- The Virtual Chemistry Laboratory: An experiment in internet-based education using remotely controlled robot manipulators (Dept. of Computer Science and Engineering and the Department of Chemistry).
- A reverse engineering and inspection system (has been implemented in an auto assembling plant).
- The robot prototyping environment (currently being packaged as software for controlling, simulating, and monitoring generic manipulators).
- An automated stock trading system that is currently in use.
- A prototype has been developed for a cell-based car mapping system.
- An academic class scheduler and advisor software (SKED), which is currently used by several academic departments.
- A face recognition / object identification software, is currently being developed for commercial deployment via an incubator established through angel investments and VC seed funds (joint work with other Universities and industry partners).
- An electronic raffle web site is being readied to go live with the help of VC funding.

Past Research Projects

- Real-time control, monitoring, and simulation of electro-mechanical systems.
- Parallel architectures for the realization of uncertainty from sensed data.
- Inspection and reverse engineering of mechanical parts.
- Modeling and Verification of Distributed Control Schemes for Mobile Robots.
- Mobile manipulation.

- Algorithms for manipulator workspace generation and visualization in the presence of obstacles.
- Parallel architectures for robust motion and structure recovery from uncertainty in sensed data.
- Advanced sensing for manufacturing.
- Uncertainty visualization in CAD systems from sensed data.
- Kinematics and dynamic hardware for multi-degree of freedom manipulators.
- Hardware realizations for discrete-event-based hybrid systems.
- A framework for timed hybrid systems representation, synthesis, and analysis.
- Internet-based tele-control of robotic manipulators.
- Graphical user interfaces for event-based monitoring and control of hybrid systems.
- Coordinate measuring machine operating system realizations using hybrid systems.
- Concurrent optimal engineering design of manipulator prototypes.
- Uncertainty visualization for tolerance analysis in manufacturing.
- Catalogue-based optimization of manipulator parameters.
- Parallel realizations for computing 3-D workspaces of redundant manipulators
- Object-oriented prototyping environments for electro-mechanical systems and robotic manipulators.
- Robotic Manipulation for Genetics Research.
- Feature-based reverse engineering and inspection of machine parts.
- Recovering manufacturing tolerancing from uncertainty in sensed data.
- Discrete event modeling and control of autonomous agents under uncertainty.
- Discrete-event-based synchronization of multi-media.
- The dynamic recursive context of finite state machines.
- Reverse engineering applications in dentistry.
- Service robotics and tire-changing robots for car racing applications.
- Sensor-based control of mobile robots.
- Calibration and singularity determination for robotic manipulators.
- Optimality for compressed communication modes.
- Error detection and correction for intelligent observers.

PATENTS AND INVENTIONS

- T. Sobh, A. Mahmood, “Multi Dimensional,Multi-Transform (MDMT) Adaptive Face Recognition System”, Patent Pending.
- T. Sobh, R. Mihali and A. Rosca, “Raffle-Based Collaborative Product Selling and Buying System”, Patent Pending.
- T. Sobh, R. Mihali, A. Rosca and T. Alameldin, “Normalized Distributed Exchange System”, Patent Pending.
- T. Sobh, “Multilingual Speech Synthesis.” Invention Disclosure, June 1994.
- G. Gopalakrishnan and T. Sobh, “Monitoring Spaces within a Parking Lot,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, June 1993.
- T. Sobh, “An autonomous sprinkler,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.
- T. Sobh and G. Gopalakrishnan, “Sprinkler system with rain, wind, and sun detector,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.
- G. Gopalakrishnan and T. Sobh, “Child crib computer,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.
- G. Gopalakrishnan and T. Sobh, “Device to fix images obtained while copying fat bound volumes,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.
- G. Gopalakrishnan and T. Sobh, “Gas-tank level indicator based on resonant acoustic tube,” Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.

- G. Gopalakrishnan and T. Sobh, "Range detector to help avoid collisions between automobiles and while parking," Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.
- T. Sobh and G. Gopalakrishnan, "Child crib computer with video monitoring unit," Invention Disclosure submitted to the University of Utah Campus Office for Inventions and Patents, November 1993.