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EDUCATION:

PhD Student in CISST - BME
Johns Hopkins University, Baltimore, MD
Expected graduate date: 2009

Master of Science in Electrical Engineering
Queen's University, Kingston, Canada.
GPA: 88%
Thesis: Optimization-Based Robot Impedance Control Design

Bachelor of Science in Electrical Engineering
Tehran University, Tehran, Iran
GPA: 84%
Research Project: Design and Implementation of Fuzzy Logic Controller for Electro-Static Filters

EXPERIENCE:

Research Assistant
Center for Computer-Integrated Surgical Systems and Technology, Baltimore MD
2005 – Present

- Carrying out research in the area of medical robotics, image guided radiation therapy, medical imaging systems and computer aided surgery
- Designed and fabricated "Nerve Tensionometer for Spondyloptosis Surgery", a biomedical sensor for measuring tension in nerve roots including a load cell, linear stage, amplification boards and PC interface
- Taking courses in robotics, medical imaging systems, MRI, computer aided surgery and computer programming

Project Manager
Real Time Systems Inc., Toronto, Canada
2004 – 2005

- Designed control and automation systems for industrial robotic applications using PLC and PC-based data acquisition systems
- Designed and programmed the control system of Town of Gore Bay Water Treatment Plant, Hard Coat Paint Line of Magna Industrial Plant, PolyBrite pH SCADA System, Canada Bread Level and Mixer System, RedPath Sugar Power House SCADA System and Maple Lodge Tank Farm Data Collection System
- Received training in Allen-Bradley, GE Fanuc, Siemens, Schneider Electric, Omron PLC hardware and software

Research Assistant
Queen's University, Kingston, Canada.
2002 – 2004

- Designed a novel compliance control methodology for controlling contact between robotic manipulators and their environments using optimal control theory
- Implemented, debugged and evaluated the above new optimal compliance controller on a robotic experimental test-bed composed of a planar twin-pantograph manipulator (can be used as force feedback haptic device), AD/DA/DD data acquisition boards, encoders, ATI force sensor, WinCon/RTX real-time operating system, MATLAB Simulink and Real-time Workshop toolboxes
- Carried out a machine vision project for detecting motion in a 2-dimensional plane using Intel Open CV C++ library and a stereocamera
- Designed a remote control system for Adept robot which by using LAN, commands could be sent to robot through a GUI and the motion of the robot displayed on a 3D visual model

COMPUTER SKILLS

- Programming languages: C++, Java, Quick Basic, Fortran
- Platforms/Operating systems: Microsoft Windows XP, 2000/NT, WinCon, VxWorks and Unix.
- Development tools: MATLAB, AutoCAD, Microsoft Office, Microsoft Project, PSpice, Protel and Labtech
- PLC related software: RsLogix500/5000, RsView Studio/32, Wonderware, Concept/Unity Pro, Cimplicity, VersaPro, PL7-Pro

AWARDS and HONORS

- Ontario Graduate Scholarship – 2003, 2004
- Queen's Graduate Award – 2002, 2003
- Top third student in the graduating class of 96 at Electrical and Computer Engineering Department of Tehran University – 1996

PROJECTS

- Image Guided Small Animal Radiation Research Platform (IG-SARRP)

In cancer research, small animals, such as mice, rats and rabbits are used extensively to evaluate the effectiveness of novel treatment as well as treatment related toxicity. In combination with advanced imaging methods, small animal research allows detailed study of biological processes, disease progression, and response to therapy, with the potential to provide a natural bridge to the clinical environment and contribute substantially to the development of human medicine. IG-SARRP will realistically model human radiation treatment methods in mice, rats and rabbits. Three specific aims of this project are:

1. Construction of SARRP which integrates imaging, radiation delivery and treatment planning capabilities. The SARRP will be equipped with a computer-controlled rotating gantry. Three kilovoltage (kV) x-ray (100 kVp to 250 kVp) sources will provide combination of imaging and treatment functions. On-board cone-beam CT (at ~ 0.5 mm resolution) and radiographic imaging will be implemented using amorphous silicon (a:Si) flat-panel detector technology. When required, remountable x-ray focusing lens will be deployed to achieve "dose painting" at ~1 mm resolution.
2. KV dose calculation based on Monte Carlo and pencile beam convolution methods will be commissioned and coupled with a clinical 3D planning system to facilitate conformal irradiation experiments on the SARRP.
3. Validation of the imaging and delivery capabilities of the system. Small animal imaging and radiation experiments will be performed to determine the precision of the radiation, to address issues of animal setup, and to explore incorporation of additional targeting information with other imaging modalities

- Nerve Tensionometer for Spondyloptosis Surgery

The goal of this work is to improve the safety of the spondyloptosis surgery procedure. Spondylosis is the spine deformities either people born with or damages their back during the early years of their life. The instrument is capable of measuring both the force and the displacement of the nerve root and correlate the measured data to determine root lengthening limit. The nerve tensionometer

screens the amount of tension in the nerve and provides a useful means of predicting impending nerve injury.

- Real-Time Implementation of the Optimal Impedance Controller

The 3-DOF (planar translation and unlimited rotation around a single axis) twin planar pantograph is a redundant robot that can be used for robotic applications as well as haptic simulations. Position-based impedance control methodology was considered for implementing the "Optimal Impedance" controller. The impedance parameters of the environment under experiment were identified through a standard off-line least square estimation algorithm. A tight PD controller for accurate position tracking was implemented and the impedance control parameters were adjusted based on the "Optimal Control" algorithm. A force observer has been designed using inverse dynamics of the twin planar pantograph to measure interaction forces. The experimental results demonstrated the superior position and force regulation of the proposed "Optimal Impedance" controller.

- Motion Detection in a 2-Dimensional Plane

Images were enhanced by blurring noise from images. Then, using image segmentation, different object are located in a 2-dimensional plane. The segmentation was based on the threshold levels of different regions of the images and an iterative method has been employed to increase the accuracy. The principal axes, eigne vectors and center of gravity of the object were computed and the displacement and rotation of the object were measured by tracking the center of gravity and rotation of directions of principle axes.