

Hooman Homayouni

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Fields of Interest

- **Applied Robotics and A.I.**
 - Motion learning, planning and control in legged robots
 - Vision, Navigation and Machine Learning
 - Biologically inspired Robotics and A.I.
 - Multi-modal decision making, autonomy and intelligence in multi-agent systems
- **Robotics Applications in the Life Sciences**
- **Human-Machine interface**

Education

- 2004-2007 **Master of Science in Bioelectrical Engineering**
School of Electrical and Computer Engineering (ECE), University of Tehran
Thesis: “Developing a Biologically Inspired Hierarchical Controller for Biped Robot Gait”
Summary: Inspired by human locomotion system, a two-layer controller for biped robot locomotion is proposed. The bottom level controller includes functional models of three spinal neural mechanisms: cutaneous reflex, stretch reflex, and central pattern generator (CPG). The top level control utilizes fuzzy rule-based inference system to actuate two main strategies derived from biomechanical studies of human locomotion, that is ankle torque control and foot placement adjustment. The general architecture of the controller agrees mainly with the subsumption structure. The controller does not require precise model of the mechanical system of the robot, yet it shows excellent ability to maintain stability of the gait, even when the robot faces large disturbances.
Supervisors: Dr. **Fariba Bahrami**, Professor **Caro Lucas**
Biomedical Eng. and Control and Intelligence Processing Center of Excellence (CIPCE) Groups
- 1998-2004 **Bachelor of Science in Electrical Engineering; Major: Power Systems**
School of ECE, University of Tehran
Thesis: “Implementation of the Interlocking Control System of a 63^{Kv}/6.3^{Kv} Power Substation Using FPGA”
Summary: A full-scale project involving FPGA programming, schematic and PCB design of the FPGA main-board, Input/Output interfaces, and a robust power supply. Two ALTERA FPGAs were used to program the interlocking logic of 12 circuit breakers and switches. The I/O interfaces was specially designed for the system to be utilized in laboratory experiments. Critical practical issues such as

distribution of the ground over the large number of chips, digital and analog ground separation, debouncing of the input switches, proper digital design in addition to signal holding to solve glitches, power dissipation of the output drivers, and proper heat radiation for the power supply. In the case of power supply and output drivers over-design was considered.

Supervisor: Dr. **Majid Sanaye-Pasand**
CIPCE and Power Systems Groups

Academic Experience

Sep. 2004–Sep. 2007 **Research Assistantship.** Control and Intelligence Processing Center of Excellence (CIPCE) group, Dept. of ECE, U of Tehran

Topic: Conducted research on modeling human locomotion system with application in bided robot gait controller

Oct. 2006–Aug. 2007 **Co-Supervised an Undergraduate Thesis,** Dept. of ECE, U of Tehran

Title: Online trunk motion adjustment in a biped robot to compensate for a slip disturbance using ZMP control

Spring 2004 **Teaching Assistant, Protection & Relay Laboratory,** Dept. of ECE, U of Tehran

Implemented an experiment setup for the purpose of simulation of the power substation interlocking control system. Developed number of experiments and exercises to accompany the setup

Fall 2003 **Teaching Assistant, Protection & Relay Laboratory,** Dept. of ECE, U of Tehran

Coordinated experiments in the area of power system analysis, power generation cost, fault detection, substation protection, distance relays, etc.

Publications

- **H. Homayouni**, F. Bahrami, “Rule-Based Approach in Control of Planar Walking of Biped Robots,” prepared for journal submission.
- **H. Homayouni**, F. Bahrami, C. Lucas, “Biologically Inspired Controller for Planar Biped Robot Gait Based on Functional Model of Human Locomotion System,” in proc. of *Int. Conf. on Control, Automation and Systems (ICCAS)*, October 2008, Seoul, Korea, pp. 1162-1167.
- **H. Homayouni**, H. Mahjoubi, F. Bahrami, and A. E. Patla, “A Hierarchical Model to Simulate Human Path Planning in an Environment with Discrete Footholds,” *Cairo Int. Biomedical Eng. Conf. (Cibec’06)*, December 2006, Cairo, Egypt.
- **H. Homayouni** and M. Sanaye-Pasand, “Modeling and Implementation of a Substation Interlocking Control System Using FPGA,” *30th Int. University Power Eng. Conf. (UPEC2005)*, September 2005, Cork, Ireland.

Presentations and Lectures

Mar. 2008	"Developing a Biologically Inspired Hierarchical Controller to Control Biped Robot Gait," 6 th annual achievements report of the CIPCE group, U of Tehran
Dec. 2007	"Rule-Based Approach in Controlling the Bipedal Walking," Guest Lecture for the <i>Control in Biological Systems</i> course, Dept. of ECE, U of Tehran
Oct. 2007	"Developing a Biologically Inspired Hierarchical Controller to Control Biped Robot Gait," Master Defense, Dept. of ECE, U of Tehran
Dec. 2005	"The Concept of Center of Pressure in Gait and Posture control," Guest lecture for the <i>Control in Biological Systems</i> course, Dept. of ECE, U of Tehran
Oct. 2005	"Muscle Physiology and its Mathematical Models," Guest lecture for the <i>Control in Biological Systems</i> course, Dept. of ECE, U of Tehran
Sep. 2005	"Modeling and Implementation of a Substation Interlocking Control System Using FPGA," poster presentation at UPEC2005, Cork, Ireland
Mar. 2004	"Utilizing PLDs and Microprocessors in Automation of Power Substation Control systems," Guest lecture for the Protection & Relay Lab., Dept. of ECE, U of Tehran

Selected Design Experiences

- Design and hardware implementation of a **Digital Cardio-tachometer** with a clip-on light sensor (LED/Photocell Paired); Dept. of ECE, U of Tehran
- **Alignment controller for solar panels.** An efficient 2 DoF controller for aligning solar panels with the sun, with morning initializer, and hysteresis property for the alignment adjustment to increase power efficiency. Iran Kit Co., Tehran, Iran.
- Design and hardware implementation of a power substation interlocking control system on FPGA with compatible I/O interfaces and power supply, Dept. of ECE, U of Tehran
- Implementation of a power substation interlocking system using a 80C51 Microprocessor with interface to a user PC for the status acquisition via LPT with handshaking, Dept. of ECE, U of Tehran
- **Smart cooling controller** for hi-fi audio power amplifiers. Based on the audio level and the device temperature, the fan speed is adjusted for minimal audible noise. Iran Kit Co., Tehran, Iran
- **Digital measurement system** for AC/DC voltage and current, temperature, and frequency (using F/V converter), Iran Kit Co., Tehran, Iran
- Designed, implemented and tested a 6MHz LC Collpits oscillator on Printed Circuit Board, Dept. of ECE, U of Tehran

Industrial Experience

Apr. 2004 – Sep. 2004	Co-op/Intern, Medical Imaging System (SIEMENS CT-Scans & Mobile X-Rays, AGFA & Codonics Imagers) Installation & Maintenance Group, Matlab Arefan Co. Ltd., Tehran, Iran (SIEMENS Exclusive agent in Iran)
Summer 2003	Co-op/Intern, R&D Group, Iran Khodro Co., Tehran, Iran Participated in the interface development for CNC machines for alternate program entry from a PC
Sep. 2000 – Mar. 2004 (Part-time)	Circuit Design, Iran Kit Corp., Tehran Iran Design, hardware implementation, and prototyping of a number of circuits for industrial, and home appliances purpose (Programmable timers/switches, over-voltage/current protectors, DC-DC converters, Audio systems, Variable Regulated Power Supplies, etc.)

Honors and Awards

2004	Ranked 270 th out of 30,000 applicants in the National Entrance Examination for Electrical Engineering Graduate Program, Iran
1998	Ranked 88 th out of 350,000 applicants in the National Entrance Examination for Undergraduate Program, Iran
1995 – 1996	Winner of the Kharazmi Student Contest Award for the hardware implementation of a Digital Oscilloscope with fast ADC and a 10x16 multiplexed LED display <ul style="list-style-type: none"> ● 1st place in the Regional round ● 3rd place in the Provincial round ● 11th place in the National round

Technical Skills

- Algorithm development environments: Matlab
- Dynamic system design & simulation: Simulink, MSC Nastran, ADAMS
- High-level languages: C
- Hardware design automation tools: OrCAD PSPICE, Protel, Max+PlusII
- Assembly language: x86
- Solid background in discrete **analog** and **digital circuit** design and hardware implementation

Administrative Experience

2005 – Present	Computer Hardware and Network Administrator of Biomedical Engineering and Bio-instruments Laboratories, ECE Dept., University of Tehran
Summer 2002	Technical Committee Manager – Iranian Student Conference in Electrical Engineering (ISCEE), University of Tehran, Tehran, Iran
Spring 2000	Technical Committee Manager – IEEE Automation Workshop, University of Tehran, Tehran, Iran

Extra-curricular Activities

- Design and implementation of power amplifiers and speaker systems
- Reading about theories on cognitive processes and the mind, and human neurophysiology
- Strategy games

Language Proficiency

- English (Fluent)
- Japanese (Basic)

References

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