

Ahmetcan ERDOGAN

Curriculum Vitae

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Education

- 2008–present *Ph.D. Candidate, Mechatronics Engineering*, graduation date 15 August 2014
Sabancı University - Istanbul, Turkey
Thesis: Optimal Exoskeleton Design and Effective Human-in-the-Loop Control Frameworks for Rehabilitation Robotics
- Designed and implemented a parallel mechanism based rehabilitation device, optimized for singularity free workspace and kinematic isotropy.
 - Introduced a novel control algorithm for contour tracking exercises that assures coupled stability while adjusting task difficulty based on user intention.
 - Designed and conducted several human subject experiments to evaluate efficacy of proposed controllers in human motor learning and rehabilitation.
- 2006–2008 *M.Sc., Electrical Engineering, Specialization in Control of Dynamical Systems*
Högskolan Dalarna - Borlänge / Sweden
Thesis: Introduction of a New Fault Detection Approach
- Implemented a model predictive fault detection algorithm for a steel pickling process using hybrid grey-box models.
 - Utilized statistical tools to identify fault parameters with saliency.
 - Analyzed effects of design variations to the algorithm performance.
- 2002–2006 *B.S., Electrical Engineering*
Istanbul Technical University - Istanbul / Turkey
Thesis: Design of Digital Thermal Protection Relay for an Induction Machine

Experience

- 2008–present **Research Assistant**
Human Machine Interaction Laboratory at Sabancı University
- Design* Performed multi-criteria design optimization in order to increase performance of parallel robots. Analyzed singular configurations with Grassmann line theory and pruned optimization workspace accordingly. Performed actuator and transmission selection to ensure passive back-drivability and manufactured the device. Derived kinematic and dynamic models of parallel mechanisms and performed experimental characterization and active gravity compensation. These devices include:
- A 4 DoF (degree of freedom) forearm/wrist robot: AssistOn-Wrist [4] Video1 Video2,
 - A 3 DoF reconfigurable ankle robot: AssistOn-Ankle [22, 23], and
 - A 3 DoF planar robot : AssistOn-Plane

<i>Force Control</i>	<p>Implemented several impedance and passivity based control techniques for force feedback devices and bilateral teleoperation. All controllers are implemented in real-time tested on physical hardware. These controllers include:</p> <ul style="list-style-type: none"> - Impedance/admittance control in SO(3) for AssistOn-Wrist [17] Video, - Passive Velocity Field Controller (PVFC) [2, 20] Video, - Position-position control architecture for bilateral control of bi-manual rehabilitation exercises Video, and - Multi-lateral control with two masters with dissimilar kinematic devices having different control authority over the slave. [3] Video.
<i>pHRI</i>	<p>Introduced novel control algorithms for physical human machine interaction that adapts based on human intention level:</p> <ul style="list-style-type: none"> - Introduced a method for on-line generation of velocity fields, such that PVFC can be used to modulate the task difficulty, while ensuring passive tracking of parametric curves [18]. - Proposed a control algorithm that ensures maximum involvement of patients into therapy scheme based on on-line velocity field generation [12]. - Implemented a BCI based controller that estimated intention levels of subjects through EEG signals, and adjust the speed of the task accordingly [10, 11]. Video
<i>Human Subject Experiments</i>	<p>Designed and performed several human-subject experiments. Analyzed results using statistical analysis tools.</p> <ul style="list-style-type: none"> - Conducted a catch trail experiment to study effects of different parameter sets on human adaptation rate while performing a rhythmic dynamic task [5, 19]. - Tested the efficacy of the proposed slacking prevention scheme with human subject experiments on healthy volunteers [7].
<i>VR</i>	<p>Implemented several virtual reality simulations and graphical user interfaces for rehabilitation applications. These studies include:</p> <ul style="list-style-type: none"> - Serious game design for rehabilitation exercises. Video - Graphical user interface for therapists. Video - Virtual reality simulations for autonomous housekeeping [1, 14, 15, 16].Video
2008–present	<p>Teaching Assistant <i>Faculty of Engineering and Natural Sciences at Sabanci University</i></p> <ul style="list-style-type: none"> - Kinematic and Dynamic Modeling, Mechanics, Control System Design - Industrial Control, Introduction to Computer Aided Drafting and Solid Modeling - Logic and Digital System Design, Inside The Milky Way
08/2005–09/2005	<p>Internship at Istanbul Technical University <i>Istanbul, Turkey</i> Research and Development in Digital Thermal Relaying with Microprocessors</p>
06/2005–08/2005	<p>Internship at ANKA Informatics <i>Istanbul, Turkey</i> Research and Development Company in the field of Mechatronics</p>
08/2004–09/2004	<p>Internship at ALARKO Contracting Group <i>Istanbul, Turkey</i> Participated in project design of electrical construction of power plants</p>

Publications

Book Chapter

- [1] Erdi Aker, Ahmetcan Erdogan, Esra Erdem, and Volkan Patoglu. *Housekeeping with Autonomous Robots: Representation, Reasoning and Execution*. Intelligent Systems Reference Library, Springer, 2013, (to appear), 2013.

Refereed Journal Papers

- [2] Mine Sarac, Mehmet Alper Ergin, Ahmetcan Erdogan, and Volkan Patoglu. Assiston-mobile: A series elastic holonomic mobile platform for upper extremity rehabilitation. *Robotica*, Accepted.
- [3] Aykut Cihan Satici, Ahmetcan Erdogan, and Volkan Patoglu. A multi-lateral rehabilitation system. *Turk. J. Elec. Eng. and Comp. Sci*, 19(5), 2011.
- [4] Ahmetcan Erdogan, Aykut Cihan Satici, and Volkan Patoglu. Design of an optimal rehabilitation robot for forearm/wrist exercises*. *International Journal of Robotics Research*, To be submitted in 2014 July.
- [5] Ahmetcan Erdogan, Ali Israr, Marcia K. O'Malley, and Volkan Patoglu. Excessive haptic feedback deteriorates performance for rhythmic dynamic task. *Transactions on Haptics*, To be submitted around 2014 September, Preliminary work is given in [19].
- [6] Ahmetcan Erdogan, Besir Celebi, Aykut Cihan Satici, and Volkan Patoglu. Design and control of AssistOn-Ankle : A reconfigurable ankle rehabilitation robot. *ROBOTICA*, To be submitted around 2014 September, Preliminary work is given in [22, 23].
- [7] Ahmetcan Erdogan and Volkan Patoglu. A systematic framework for theurapatic exercises with slacking prevention. *Journal of NeuroEngineering and Rehabilitation*, To be submitted around 2014 September, Preliminary work is given in [12].

Dissertation and Master Thesis

- [8] A. Erdogan, "Optimal exoskeleton design and effective human-in-the-loop control frameworks for rehabilitation robotics*," Scheduled defence date 14 August, Sabancı University, Turkey 2014.
- [9] A. Erdogan and N. Ballık, "Introduction of a new fault detection approach," January, Högskolan Dalarna, Sweden 2008.

International Refereed Conference Papers

- [10] Mine Sarac, Ela Koyas, Ahmetcan Erdogan, Mujdat Cetin, and Volkan Patoglu. Brain computer interface based robotic rehabilitation with online modification of task speed. In *IEEE International Conference on Rehabilitation Robotics, (ICORR2013)*., 2013.
- [11] E. Koyas, M. Sarac, A. Erdogan, M. Cetin, and V. Patoglu. Control of a BCI-based upper limb rehabilitation system utilizing posterior probabilities. In *21st Signal Processing and Communications Applications Conference (SIU2013)*, pages 1–4, 2013.
- [12] Ahmetcan Erdogan and Volkan Patoglu. Slacking prevention during assistive contour following tasks with guaranteed coupled stability. In *International Conference on Intelligent Robots and Systems, IEEE/RSJ, (IROS2012)*., pages 1587–1594, 2012.

- [13] Gurdal Ertek, Ahmetcan Erdogan, Volkan Patoglu, Murat M. Tun, Ceyda Citak, and Tugce Vanli. Encapsulating and representing the knowledge on the evolution of an engineering system. In *Asme Idetc/Cie 2012*, August 2012.
- [14] Erdi Aker, Ahmetcan Erdogan, Esra Erdem, and Volkan Patoglu. Housekeeping with multiple autonomous robots: Knowledge representation and automated reasoning for a tightly integrated robot control architecture. In *Workshop on Knowledge Representation for Autonomous Robots, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2011)*, 2011.
- [15] Erdi Aker, Ahmetcan Erdogan, Esra Erdem, and Volkan Patoglu. Causal reasoning for planning and coordination of multiple housekeeping robots. In *International Conference on Logic Programming and Nonmonotonic Reasoning (LPNMR2011)*, 2011.
- [16] Erdi Aker, Ahmetcan Erdogan, Esra Erdem, and Volkan Patoglu. Housekeeping with multiple autonomous robots: Representation, reasoning and execution. In *International Symposium on Logical Formalization on Commonsense Reasoning (Commonsense2011)*, 2011.
- [17] Ahmetcan Erdogan and Volkan Patoglu. Kinematics and control of a 3RPS-R mechanism using euler parameters. In *ECCOMAS Thematic Conference on Multibody Dynamics*, 2011.
- [18] Ahmetcan Erdogan and Volkan Patoglu. Online generation of velocity fields for passive contour following. In *IEEE World Haptics Conference (WHC2011)*, 2011.
- [19] Ahmetcan Erdogan, Ali Israr, Marcia K. O'Malley, and Volkan Patoglu. Rate of human motor adaptation under varying system dynamics. In *IEEE World Haptics Conference (WHC2011)*, 2011.
- [20] Ahmetcan Erdogan, Aykut Cihan Satici, and Volkan Patoglu. Passive velocity field control of a forearm-wrist rehabilitation robot. In *International Conference on Rehabilitation Robotics (ICORR2011)*, 2011.
- [21] Björn Sohlberg, Yisihak Chakiso Aloto, Ahmetcan Erdogan, and Neslihan Erdogan. Model based fault detection and isolation by fault parameter elimination. In *13th Symposium on Automation in Mining, Mineral and Metal Processing, (IFACMMM2010)*., August 2010.
- [22] Aykut Cihan Satici, Ahmetcan Erdogan, and Volkan Patoglu. Design of a reconfigurable ankle rehabilitation robot and its use for the estimation of the ankle impedance. In *IEEE International Conference on Rehabilitation Robotics, (ICORR2009)*., pages 257 –264, 2009.
- [23] Ahmetcan Erdogan, Aykut Cihan Satici, and Volkan Patoglu. Design of a reconfigurable force feedback ankle exoskeleton for physical therapy. In *International Conference on Reconfigurable Mechanisms and Robots, ASME/IFTOMM, (ReMAR 2009)*, pages 400 –408, 2009.

*Confidential copies of these drafts would be shared upon request.

Relevant Coursework

- Kinematics and Dynamics, Force Control Applications, Teleoperation, Optimal Control, Multidisciplinary Design Optimization, Cognitive Robotics, and
- Modeling and Identification of Dynamic Systems, Model Based Control Systems, Measurement Systems, Fuzzy Logic, Artificial Neural Networks.

Technical Skills

Proficient (used on a daily basis for projects)

Matlab, C, SolidWorks, Quanser Real time Tools

Competent (moderate-sized scripts and semester or longer projects)

C++, L^AT_EX, SPSS, AutoCAD

Basic(small programs and scripts)

Mathematica, TOMLAB, SolidCAM

Operating Systems and Misc.

Windows, MS Office, Adobe Suite, Linux

Honors and Awards

Sabanci University tuition waiver for graduate studies

Tubitak Project Scholarship for Graduate Education

Travel Scholarships from ECCOMAS MultiBody Dynamics 2011, Belgium

Miscellaneous

Citizenship: TURKEY

Marital Status: Married

References

Volkan Patoglu (Ph.D. Adviser)

Associate Professor

Mechatronics Engineering

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