Ozan Tokatli | PhD

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Education

Sabanci University **Istanbul, Turkey**
PhD, Mechatronics Engineering *2010–2015*
Thesis: Fractional order control in haptics

Sabanci University **Istanbul, Turkey**
MSc, Mechatronics Engineering *2008–2010*
Thesis: A novel approach to micro-telemanipulation with soft slave robots: Integrated design of a non-overshooting series elastic actuator

Sabanci University **Istanbul, Turkey**
BSc, Mechatronics Engineering *2004–2008*

Research Interests

Physical Human-Robot Interaction (Teleoperation, Haptics, Shared Control), Kinematics, Series Elastic Actuation, Robotics, Control

Research Experience

Title: Fractional order control in haptics *(PhD Thesis)*

Supervisor: Volkan Patoglu

- Proposed a novel impedance control topology based on fractional order calculus.
- The proposed controller supplies damping proportional to *arbitrary* order derivative of position.
- Stability, passivity, transparency of the proposed controller analysed.
- Obtained promising results for a better off stability robustness–transparency trade-off.
- A viscoelastic tissue modelled with fractional order calculus is rendered
- Published 2 papers in leading conferences.

Title: A novel approach to micro-telemanipulation with soft slave robots: Integrated design of a non-overshooting series elastic actuator *(MSc Thesis)*

Supervisor: Volkan Patoglu

- Designed a compliant mechanism based series elastic actuator (SEA) for tele-manipulation of for MEMS applications.
- The mechanism was optimised for better force resolution and disturbance rejection using multi-criteria design framework. Robustness to manufacturing errors was included into the mechanism design phase.
- Designed a non-overshooting controller for the force control of the SEA.
- Published 7 papers in conferences and a journal.

Title: 3D learning in a rich cooperative haptic environment

Supervisors: William Harwin and Faustina Hwang

- Investigated the efficacy of haptic systems in classroom for enhancing the science education.
- Built an immersive virtual environment depicting a generic animal cell with transport proteins and molecules such as O_2, CO_2.
- Conducted human subject experiments with students.
- Immersive virtual environments and a manipulation interface improve the learning of challenging science

subject
- Haptic feedback during manipulation did not contributed to learning.
- Published 4 conference papers and a journal paper will be submitted.

Title: Developing shared-control algorithm for glove box tele-manipulator

Supervisor: Ozan Tokatli

- Developed a shared control algorithm for improving safety in a unilateral teleoperator.
- To assist the operator, the motion reference from the master side is scaled relative to the distance from obstacles.
- Human subject experiments are halted due to Covid-19 outbreak.

Title: Utilising secondary objectives in the inverse kinematics solution of a robot for assisting teleoperation in confined spaces

Supervisor: Ozan Tokatli

- Developed an inverse kinematics algorithm for redundant manipulators.
- The proposed approach handles the collision avoidance between the robot links and the obstacles in the environment.
- The inverse kinematics solutions are singularity free for easier teleoperation.
- A journal paper is being written.

Title: Learning skills from human demonstrations for assistive tele-manipulation

Supervisor: Ioannis Havoutis

- The goal of the project is to assist the operator in tele-manipulation.
- The assistance is handled as a skill to be learned from the operator.
- Learning from demonstration is used to acquire model for manipulation skills such as brushing.
- This is an ongoing project.

Title: HANDSON-SEA: an admittance type haptic interface for education

Supervisors: Ozan Tokatli and Volkan Patoglu

- Co-supervised an MSc student.
- Designed a 1 degree-of-freedom, low-cost, robust, series elastic actuation based haptic interface for engineering education.
- The novelty of the design includes using a cross flexure joint as the compliant element of a series elastic actuator.
- The effectiveness of the device in educational use was shown with undergraduate students taking Introduction to Robotics course.
- Published 2 conference papers and submitted a journal paper.
- The device received best demo award at World Haptics 2017.

Title: Fractional Order Admittance Control for pHRI

Supervisors: Volkan Patoglu and Cagatay Basdogan

- Collaborated with colleagues from Turkey, we extended my PhD work to human robot collaboration.
- Introduced a novel admittance control topology and a controller synthesis framework.
- Both theoretically and experimentally showed that the new control topology is leading to better off stability robustness and transparency performance.
- Published 2 conference and 2 journal papers

Title: Design of a spherical wheel

Supervisors: Ozan Tokatli and Volkan Patoglu

- Co-supervised an undergraduate final year project group.

- Designed, built and controlled a spherical wheel robot (ballbot)
- Designed from low-cost parts and off-the-shelf electronics

Experience

Vocational

Oxford University — **Oxford, UK**
Visiting Researcher — *April 2021–October 2021*

United Kingdom Atomic Energy Authority — **Culham, UK**
Research Engineer — *2018–Current*

University of Reading — **Reading, UK**
Post-doctoral Research Assistant — *2015–2018*

Aselsan Inc — **Ankara, Turkey**
Trainee — *July 2007*

Teaching

Calculus: Teaching Assistant, Sabanci University, Spring 2014

Linear Algebra: Teaching Assistant, Sabanci University, Fall 2013

Introduction to Robotics: Teaching Assistant, Sabanci University, Fall 2012

Ordinary Differential Equations: Teaching Assistant, Sabanci University, Fall 2010

Mechanics: Teaching Assistant, Sabanci University, Spring 2009

Kinematics and Dynamics of Machinery: Teaching Assistant, Sabanci University, Spring 2008

Programme Committees

Eurohaptics 2016: Local arrangement chair of the conference

Haptics in Education: Organiser of the workshop held as part of IEEE World Haptics 2017

fi-re 2019: Organiser of the workshop on physical human-robot interaction

RAIN HRI Workshop (2020): Organiser of the workshop on human-robot interaction and the chair for teleoperation session

Reviewer

- Transactions on Robotics
- IEEE Transactions on Mechatronics
- Advance Robotics
- Haptic Symposium
- Robotics and Automation Letters
- IEEE Transactions on Haptics
- IEEE World Haptics
- Eurohaptics

Scholarships

Tuition waiver for graduate education: 2010–2015, Sabanci University

Tubitak-BIDEB Scholarship for Graduate Education: 2010–2015, TUBITAK-BIDEB

Tuition waiver for graduate education: 2008–2010, Sabanci University

Tubitak-BIDEB Scholarship for Graduate Education: 2008–2010, TUBITAK-BIDEB

Merit Scholarship for undergraduate education: 2004–2008, Sabanci University

Publications

Google Scholar profile:
https://scholar.google.co.uk/citations?user=U4NdQacAAAAJ&hl=en

Journals

[30] A. Altobelli, O. Tokatli, G. Burroughes, and R. Skilton, "Optimal grasping pose synthesis in a constrained environment," *Robotics*, vol. 10, no. 1, 2021.

[29] A. Otaran, O. Tokatli, and V. Patoglu, "Physical human-robot interaction using handson-sea: An educational robotic platform with series elastic actuation," *IEEE Transactions on Haptics*, 2021.

[28] O. Tokatli, P. Das, R. Nath, L. Pangione, A. Altobelli, G. Burroughes, E. T. Jonasson, M. F. Turner, and R. Skilton, "Robot-assisted glovebox teleoperation for nuclear industry," *Robotics*, vol. 10, no. 3, 2021.

[27] M. E. Webb, M. Tracey, W. Harwin, O. Tokatli, F. Hwang, R. Johnson, N. Barrett, and C. Jones, "Haptic-enabled collaborative learning in virtual reality for schools," *Education and Information Technologies*, 2021.

[26] Y. Aydin, O. Tokatli, V. Patoglu, and C. Basdogan, "A computational multi-criteria optimization approach to interaction controller design for phri systems (accepted)," *Transactions on Robotics*, 2020.

[22] ——, "Stable physical human-robot interaction using fractional order admittance control," *IEEE Transactions on Haptics*, 2018.

[9] O. Tokatli and V. Patoglu, "Nonovershooting force control of a series elastic actuator," *Solid State Phenomenon*, 2010.

Conferences

[25] D. Sirintuna, Y. Aydin, O. Caldiran, O. Tokatli, V. Patoglu, and C. Basdogan, "A variable-fractional order admittance controller for phri," in *The International Conference on Robotics and Automation (ICRA)*, 2020.

[24] M. Webb, M. Tracey, W. Harwin, O. Tokatli, F. Hwang, N. Barrettx, C. Jones, and R. Johnson, "An investigation of the impact of haptics for promoting understanding of difficult concepts in cell biology," in *Open Conference on Computers in Education*, 2019.

[23] M. Webb, M. Tracey, W. Harwin, O. Tokatli, F. Hwang, R Johnson, N. Barrett, and C. Jones, "Design considerations for haptic-enabled virtual reality simulation for interactive learning of nanoscale science in schools," in *International Conference on Immersive Learning*, 2019.

[21] A. Otaran, O. Tokatli, and V. Patoglu, "Handson-computing: Promoting algorithmic thinking through haptic educational robots," in *EuroHaptics*, 2018.

[20] O. Tokatli, M. Tracey, F. Hwang, N. Barrett, C. Jones, M. Webb, and W. Harwin, "A classroom deployment of a haptic system for learning cell biology," in *EuroHaptics*, 2018.

[19] Y. Aydin, O. Tokatli, V. Patoglu, and C. Basdogan, "Fractional order admittance control for physical human-robot interaction," in *IEEE World Haptics*, 2017.

[18] M. Webb, M. Tracey, W. Harwin, O. Tokatli, F. Hwang, R Johnson, N. Barrett, and C. Jones, "The potential for haptic-enabled interaction to support collaborative learning in school biology," in *Society for Information Technology and Teacher Education*, 2017.

[17] A. Otaran, O. Tokatli, and V. Patoglu, "Hands-on learning with a series elastic educational robot," in *EuroHaptics*, 2016.

[16] O. Tokatli and V. Patoglu, "Generalized virtual environment models for haptic rendering," in *Symposium on Theory of Machines and Mechanisms(TrISToMM)*, 2015.

[15] ——, "Stability of haptic systems with fractional order controllers," in *IEEE/RSJ International Conference on Intelligent Robotsand Systems (IROS)*, 2015.

[14] ——, "Using fractional order elements for haptic rendering," in *International Symposium on Robotics Research (ISRR)*, 2015.

[13] ——, "Design of a compliant manipulator for removing malign cancer tissue through hydrodynamic cavitation," in *ECCOMAS Multibody Dynamics*, 2011.

[12] ——, "Series elastic actuation for force controlled micro-manipulation," in *IEEE International Conference on Mechatronics*, 2011.

[8] ——, "Nonovershooting force control of a series elastic actuator," in *IEEE International Conference on Mechatronics*, 2010.

[7] ——, "Optimal design of a series elastic actuator," in *ASME International Design Engineering Technical Conferences and Computers and Information Engineering Conference*, 2010.

[6] ——, "Robust optimal design of a micro gripper," in *The First Joint Conference on Multibody System Dynamics*, 2010.

[5] ——, "Robust optimal design of a micro series elastic actuator," in *AzCIFToMM International Symposium of Mechanisms and Machine Science*, 2010.

[4] ——, "Seri elastik eyleyicinin tasarimi ve denetimi (design and control of a series elastic actuator)," in *Otomatik Kontrol Ulusal Toplantisi*, 2010.

[3] ——, "Multi-criteria optimization of a compliant half pantograph," in *ECCOMAS Multibody Dynamics*, 2009.

Thesis

[11] O. Tokatli, "Fractional order control in haptics," PhD thesis, Sabanci University, Istanbul, Turkey, 2010.

[10] ——, "Robust optimal design and control of a micro series elastic actuator," Master's thesis, Sabanci University, Istanbul, Turkey, 2010.

In progress

[2] O. Tokatli and V. Patoglu, "Haptics with fractional order control."

[1] O. Tokatli, M. Tracey, F. Hwang, N. Barrett, C. Jones, M. Webb, and W. Harwin, "Technology enhanced learning using haptics."

Membership

IEEE, Turkish Machine Theory Association (member of IFToMM)

Languages

Turkish (native speaker), English (fluent)

Computer skills

Programming languages: Python, Matlab/Simulink, C/C++, Mathematica

Engineering tools: ROS, Unreal Engine, SolidWorks, Autolev, Git, Docker

References

- **Professor Volkan Patoglu**
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  http://myweb.sabanciuniv.edu/vpatoglu/
- **Professor William Harwin**
  Biomedical Engineering, University of Reading, UK
  w.s.harwin@reading.ac.uk
  http://www.personal.reading.ac.uk/~shshawin/
- **Professor Cagatay Basdogan**
  Mechanical Engineering, Koc University, Turkey
  cbasdogan@ku.edu.tr
  http://home.ku.edu.tr/~cbasdogan/