1.   Personal information

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Soft Robotics Laboratory (SRL)
Department of Mechanical and Process
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ETH Zurich, 8092 Zurich, CH

2.   Education

09/13 – 05/18   **PhD** in Mechanical Engineering, MIT, MA, USA, *Thesis:* "Building and Controlling Fluidically Actuated Soft Robots: From Open Loop to Model-based Control", PhD defense date: 18/05/18, *Thesis Committee:* Daniela Rus, Russ Tedrake, John Leonard, Peko Hosoi

10/07 – 01/13   **Diplom-Ingenieur** (equiv. Bachelor & Master) in Mechanical Engineering, KIT, Germany

3.   Employment history

07/20 – pres.   **Assistant Professor (Tenure-Track) of Robotics**, D-MAVT, ETH Zurich, CH
07/19 – 06/20   **Chief Technology Officer (CTO)**, Dexai Robotics, Somerville, MA, USA
11/18 – 06/19   **Senior Applied Scientist**, Amazon Robotics LLC., North Reading, MA, USA
06/18 – 11/18   **Postdoctoral Associate**, Distributed Robotics Laboratory, Computer Science and Artificial Intelligence Laboratory, MIT, MA, USA, Advisor: *Prof. Daniela Rus*
09/13 – 05/18   **Graduate Research Assistant**, Distributed Robotics Laboratory, Computer Science and Artificial Intelligence Laboratory, MIT, MA, USA, Advisor: *Prof. Daniela Rus*
01/16 – 12/17   **Robotics Consultant**, Seadrone Inc., Palo Alto, CA, USA
12/12 – 08/13   **Robotics Systems Engineer,** Auris Health, Inc., Redwood City, CA, USA
04/12 – 11/12   **Graduate Research Assistant** (Master's Thesis), Artificial Intelligence Laboratory, Stanford University, CA, USA, Advisors: *Dr. Torsten Kröger*, *Prof. Oussama Khatib*
08/11 – 02/12   **Robotics Research Internship**, ABB (China) Ltd., Advisors: *Dr. Jens Hofschulte*

4.   Institutional responsibilities

01/21   **Admissions Committee Member**, M.Sc. in Robotics, Systems + Control, ETH, CH
07/20 – pres.   **Head of the Soft Robotics Laboratory**, D-MAVT, ETH Zurich, CH
07/19 – 06/20   **Chief Technology Officer**, Dexai Robotics LTD, Somerville, MA, USA

5.   Approved research projects as principal investigator

12/22 - pres.   **HOLCIM** Research Scholarship for Dr. Oncay Yasa, CHF 100k
10/22 - pres.   **FESTO** Research Project on Soft Robotic Hands, PI, CHF 41k
06/22 - pres.   **Armasuisse** ARAMO, PI, CHF 40k
06/22 - pres.   **Armasuisse** MetaSuit, PI, CHF 20k
06/22 - pres.   **Armasuisse** SURF-eDNA, PI, CHF 40k
05/22 - pres.   **NCCR Spin-off Funding Robotic Grippers,** CHF 50k
05/22 - pres.   **Amazon Robotics Research Award (ARA)** Manipulation Design Optimization, USD 100k
05/22 - pres.   **RobotX Research Program** Representations for Robotic Manipulation, PI, CHF 172k
03/22 - pres.   **ALIVE Engineering with Living Materials** Biohybrid Robots, PI, CHF 100k
03/22 - pres.   **Armasuisse** Flying Gripping, PI, CHF 20k
03/22 – 02/25.   **ETH Grant** Optimizing Fluidic Soft Robots with Differentiable, Multiphysics-Informed Neural Networks, PI, CHF 227k
01/22 – 12/22.   **Olga Mayenfisch Stiftung** on Tissue-engineered Biohybrid Artificial Heart, PI, CHF 50k
12/21 - pres.   **Zurich Heart** Project on Electrostatically actuated Muscles, PI, CHF 100k
09/21 – 5/22.   **FESTO** Research Project on Robotic Fingers, PI, CHF 50k

6.   Supervision of junior researchers at graduate and postgraduate level

Postdocs: Dr. Miriam Filippi (Biohybrids), Dr. Oncay Yasa (Biohybrids)

Doctoral Students: Thomas Buchner (Electrostatic robots), Barnabas Gavin Cangan (Proprioceptive robots), Elvis Nava (Physics-informed meta-learning), Hehui Zheng (Physics-informed Shape Tracking), Lewis Jones (Printed biohybrid heart), Aiste Balciunaite (Biohybrids), Mike Michelis (Multi-physics learning)**,** Amirhossein Kazemipour (Electrostatic actuators), Yasunori Toshimitsu (Soft Manipulation)

Master's Student Thesis works: 50

7.   Teaching activities

09/21 - pres.	**Focus Project,** Current project: surf.ethz.ch and metasuit.ethz.ch, yearly, ETH Zurich, CH
06/21 - pres.	**Robotics Summer School,** teaching lab for visiting researchers, ETH Zurich, CH
02/21 - pres.	**Soft and Biohybrid Robotics Class**, yearly, ETH Zurich, CH
02/21 - pres.	**MaP Distinguished Lecture Series on Soft Robotics,** yearly, ETH Zurich, CH
09/20 - pres.	**Distinguished Seminar in Robotics, Systems and Control**, yearly, ETH Zurich, CH
09/15 – 12/16	**Mentor** for undergraduate and graduate students at the MIT makerspace on the use of machine shop tools, MIT, MA, USA
04/15 + 04/19	**Graduate Class 9.357 Current Topics in Perception**, guest lecturer, MIT, USA
10/08 – 06/11	**Teaching Assistant** for the Courses: Control, machine design, mathematics, technical mechanics; Biweekly tutorials; Karlsruhe Institute of Technology, GER

8.   Membership in panels, boards, and individual scientific reviewing activities

01/23 – pres.	**Editor** International Journal of Robotics Research (IJRR)
01/22 – pres.	**Associate Editor** IROS + RA-L
04/21	**Panel Member & Reviewer** The Academy of Finland Research Grants
02/21 – pres.	**Area Chair/Associate Editor** Robotics: Science and Systems (RSS) ('21 + '22)
10/20	**Reviewer** ETH Bridging Grants [1x]
04/20	**Panel Member & Reviewer** US National Science Foundation (NSF) Grants
02/19 – 03/21	**Guest Editor of Special Issue** IJRR on topic "Soft Robotic Modeling and Control: Bringing Together Articulated Soft Robots and Soft-Bodied Robots"
10/15 – pres.	**Reviewer Journals:** Nature [2x], Nature Scientific Reports [2x], Science Robotics [7x], Science Advances [1x], Advanced Materials [1x], PNAS [1x], Soft Robotics [7x], ASME [1x], IEEE Robotics Automation Letters (RA-L) [8x], IEEE Transaction Mechatronics [1x], IEEE Transaction on Robotics [3x], IEEE Access [1x], MDPI Robotics, Micromachines [2x]
03/14 – pres.	**Reviewer Conferences**: IEEE ICRA [12x], IEEE IROS [9x], IEEE RoboSoft [5x], Robotics: Science and Systems (RSS) [1x]

9.   Active memberships in scientific societies, fellowships in renowned academies

02/22 – pres.	**TED Fellow,** TED Fellow Program, TED Conferences LLC
02/22 – pres.	**Regular Member**, Tissue Engineering + Regenerative Medicine Int. Soc. (TERMIS)
10/21 – pres.	**Executive Board Member**, ALIVE Engineering with Living Materials, ETH Zurich, CH
10/21 – pres.	**Core Faculty Member** of the ETH AI Center, ETH Zurich, CH
12/21 – pres.	**Associated Member** of NCCR Robotics, CH
12/20 – pres.	**Associated Member** of Max Planck ETH Center for Learning Systems, GER - CH
07/20 – pres.	**Core Faculty** of RobotX, ETH Zurich, CH
04/13 – pres.	**Member** of the Institute of Electrical and Electronics Engineers (IEEE)

10.   Organization of conferences

10/22 – pres.	**Workshop Co-Chair**, RoboSoft 2023 Singapore
04/22	**Organizer**, RoboSoft 2022 workshop on "Software for Soft Robotics", Edinburgh, UK
10/18	**Organizer**, IROS 2018 workshop on "Soft Robotic Modeling + Control", Spain
09/15 – 09/16	**Organizing Chair** of Mechanical Engineering Research Exhibition (MERE), USA

11.   Prizes, awards, fellowships

02/22	**TED Fellowship Award,** TED Fellow Program, TED Conferences LLC
04/18	**Outstanding Paper Award** at IEEE RoboSoft 2019, Seoul, South Korea
09/14	**"Tony Stark Award for a Bad-Ass Live Demonstration"**, MIT Research Exhibition, USA
07/14	**Redtenbacher-Preis** for the outstanding result in Diplom-Ingenieur (equiv. Bachelor & Master) studies, awarded by the Faculty of Mechanical Engineering, KIT, Germany
09/13 – 03/14	**Graduate Exploration Fellowship**, MIT, MA, USA
03/12 – 11/12	**IGEL Fellowship** by the Faculty of Computer Science, KIT, Germany
03/12 – 11/12	**Fellowship** by the Kurt Fordan Foundation, Germany
03/12 – 11/12	**Fellowship** by the Dr.-Ing. Willy-Höfler Foundation, Germany
02/11 – 02/12	**Fellowship "Heinz Nixdorf Program for the Promotion of Asian-Pacific Experience for Young Professionals"** by the German Association for International Cooperation
02/10	**Grashof Award** for outstanding accomplishments and the best final result in the basic study of mechanical engineering in 2009, KIT, Germany
02/10 – 01/13	**Fellowship "Schaeffler Top Student"** by the Schaeffler Group, Germany
09/09 – 09/12	**Fellowship** by the Friedrich Naumann Foundation for Freedom, Germany

Real-World Deployed Soft Robotic Fish

As project lead during my PhD, I designed and fabricated SoFi, the first fully integrated soft robot operating autonomously in the ocean to explore the behaviors of real fish [1]. SoFi's innovation is its actuated biomimetic soft tail that not only mimics the propulsive undulation of real fish but allowed us to unintrusively spy on marine life. My four publications on SoFi (Katzschmann et al. '16/'16/'18; Marchese, Katzschmann et al. '15) have 1306 citations, were cited in multiple review papers, led to invited talks at TechCrunch Sessions '17, RoboSoft '19, SciFoo '22, NCCR Bioinspired Materials '22, and TED '22. In '18, my work also attracted the attention of leading news outlets: NYTimes, Wall Street Journal, National Geographic, BBC, etc.

As a PI, I proposed the computational co-optimization of SoFi's design and control. My team and I developed a fast differentiable method for co-designing a soft swimmer's geometry and controller [2]. Our gradient-based approach discovers new swimmer designs and control policies within just a few iterations while gradient-free solutions would mostly fail to succeed.

We demonstrated the method's efficacy on multi-objective problems, such as fast, stable, and energy-efficient swimming. The work led to an invited talk at RoboSoft '22. Our differentiable approach now allows researchers to automatically optimize material and control parameters of their soft robotic designs (Zhang et al. IROS '22, Gravert et al. IROS '22). We can now couple deep learning fluid models with continuum solid mechanics to quickly optimize the controls of soft robotic fish in an accurate simulation (Nava et al. ICML '22).

First Soft Proprioceptive Hands

As a first-author PhD student, I created the first dynamically controllable soft robotic manipulator that despite its infinite degrees of freedom can reliably perform object grasping (157 citations, 1 invited talk) [1]. As co-lead, I developed the Printable Hydraulics method that creates functional hydraulic soft robotic grippers in single prints (211 citations) [2]. As joint first author, I designed and built a casted soft hand with integrated sensors, that could for the first time grasp and identify objects based only on its internal measurements (292 citations) [3]. As a co-lead, I then demonstrated the first proprioceptive object manipulation with a fully printed soft robotic hand (Best Paper Award at RoboSoft '19, 46 citations) [4]. My work on soft robotic hands led to five publications cited 824 times and invited talks at IROS '15, ICRA '16, GRC Robotics '20, and ICRA '21. In '15, the BBC, Scientific American, Popular Science, etc. wrote about this work. During my industrial work at Amazon, I created soft suction grippers ("Robin") that have already manipulated millions of packages (patent US10913165B1, '19).

First Dynamic Control of Soft Robotic Arms

As first author, I created soft robotic arms and dynamic control algorithms that allowed for fast motion despite infinite degrees of freedom [1]. As co-lead, I conceived an impedance and dynamics model that enabled the first time application of control techniques developed for rigid robots to the dynamic control of soft robots [2]. This led to 465 citations in four publications, invited talks at RoboSoft '18/'19, one organized workshop at IROS '18 with >100 attendants, and a special issue at IJRR on the topic with 25 accepted papers.

As PI, I conceived the first proprioceptive soft arm that estimates its own state using internal capacitive flex sensors and a fast dynamical model instead of external motion capture; robots can now operate in obstructed and visually occluded environments that disallow exteroceptive measurements (IROS '21). I then conceived a dynamic controller that for the first time allows soft robotic arms to perform a variety of real-world tasks such as picking, throwing objects, drawing, or avoiding obstacles [3]. Within the last two years, we published six papers on this topic, and have already received 21 citations. As a result of this work, I organized a RoboSoft '22 workshop with 50 participants and was invited for talks (Hamlyn Symposium '21, NCCR Bio-Inspired Materials '22), keynotes (ICCAR '22 and ICAARS '22), and advanced schools (SMART Winter School '21, Deformation in Robotics '22).