

# George P. Kontoudis

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## RESEARCH INTERESTS

My research interests lie in the intersection of **robotics**, **control theory**, and **machine learning**. What interests me most is the formulation of hybrid theoretical schemes and the development of novel robotic systems to bridge the gap between machine learning and autonomy. I am particularly interested in how learning algorithms and control theory can enable multi-agent systems to efficiently collaborate with minimal information exchange for robotic navigation and exploration tasks.

## PROFESSIONAL & RESEARCH EXPERIENCE

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|--|--------------------------|
| <b>Assistant Professor, Colorado School of Mines</b><br>Department of Mechanical Engineering   | <i>Jan 2024–present</i>  |
| <b>Postdoctoral Research Associate, University of Maryland</b><br>Motion and Teaming Lab (PI: Michael Otte)  | <i>Jan 2022–Dec 2023</i> |
| <b>Graduate Research Assistant, Virginia Tech</b><br>Center for Marine Autonomy & Robotics (PI: Daniel J. Stilwell)<br>Computational Multiphysics Systems Laboratory (PI: Tomonari Furukawa) | <i>Aug 2016–Dec 2021</i> |
| <b>Undergraduate Research Assistant, National Technical University of Athens</b><br>Control Systems Laboratory (PI: Kostas J. Kyriakopoulos)   | <i>Apr 2014–Mar 2016</i> |
| <b>Founder &amp; Research Associate, OpenBionics</b>   | <i>Sep 2014–present</i>  |

## EDUCATION

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|---|------------------|
| <b>Ph.D. in Electrical Engineering, Virginia Tech</b><br>Dissertation Title: “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration”                                 | <i>2018–2021</i> |
| <b>M.S. in Mechanical Engineering, Virginia Tech</b><br>Thesis Title: “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation”   | <i>2016–2018</i> |
| <b>Diploma (B.S. &amp; M.S.) in Mechanical Engineering, National Technical University of Athens</b><br>Thesis Title: “Design and Development of an Underactuated, Anthropomorphic Robot Hand” | <i>2012–2016</i> |
| <b>B.S. in Mechanical Engineering, University of West Attica</b>  | <i>2005–2010</i> |

## TEACHING EXPERIENCE

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|--|--------------------|
| <b>Instructor, MEGN544 Robot Mechanics: Kinematics, Dynamics, and Control</b><br>Department of Mechanical Engineering, Colorado School of Mines  | <i>Fall 2024</i>   |
| <b>Instructor, MEGN315 Dynamics</b><br>Department of Mechanical Engineering, Colorado School of Mines<br>Participation: 31 undergraduate students (S ’24)<br>Evaluation: 4.04/5.00 (S ’24) | <i>Spring 2024</i> |
| <b>Co-Instructor, ENAE488O/788O Introduction to Autonomous Multi-Robot Swarms</b><br>Department of Aerospace Engineering, University of Maryland   | <i>Spring 2023</i> |
| <b>Graduate Teaching Assistant, ME4005 Mechanical Engineering Lab I</b><br>Department of Mechanical Engineering, Virginia Tech   | <i>Spring 2017</i> |
| <b>Graduate Teaching Assistant, ME4006 Mechanical Engineering Lab II</b><br>Department of Mechanical Engineering, Virginia Tech  | <i>Fall 2016</i>   |

## AWARDS & HONORS

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|--|-----------------|
| NSF FRR-NRI Aspiring Robotics PI                                 | 2023, 2024      |
| 2022 Robotics: Science and Systems (RSS) Pioneer                 | 2022            |
| 2022 MRC Postdoctoral Fellowship (\$60K)                         | 2022            |
| 5 × IEEE Student Travel Support for IROS, ACC, and CDC           | 2015, 2019–2021 |
| 2 × Virginia Tech GSA Travel Fund Award for Humanoids and ICORR  | 2019, 2020      |
| NSF Student Travel Grant for WuWNet (\$1K)                       | 2019            |
| NTUA Thomaideion Award for IROS                                  | 2016            |
| Hackaday Prize, 2 <sup>nd</sup> place among 900 projects (\$10K) | 2015            |
| Robotdalen Innovation Award, 1 <sup>st</sup> place (SEK 100K)    | 2015            |

## INDUSTRY EXPERIENCE

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|---|-------------------|
| Mechanical Engineer, Sychem S.A.                        | Oct 2010–Aug 2015 |
| Aircraft Maintenance Engineer Trainee, Olympic Aviation | May 2008–Jan 2010 |

## PUBLICATIONS

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<sup>+</sup> denotes student advisee co-author

<sup>\*</sup> denotes student mentee co-author

### Journal Manuscripts Under Review (J:UR)

- [2] Josh Netter<sup>\*</sup>, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Decentralized Multi-Agent Motion Planning Using Cognitive Hierarchy and Gaussian Process Classification.”
- [1] **George P. Kontoudis**, Daniel J. Stilwell, “Multi-Robot Learning using Covariance-Based Nearest Neighbor Gaussian Processes.”

### Referred Journal Publications (J)

- [6] **George P. Kontoudis**, Daniel J. Stilwell, “Scalable, Federated Gaussian Process Training for Decentralized Multi-Agent Systems,” *IEEE Access*, 2024.
- [5] Zirui Xu<sup>\*</sup>, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Online and Robust Intermittent Motion Planning in Dynamic and Changing Environments,” *IEEE Transactions on Neural Networks and Learning Systems*, 2023. (early access)
- [4] **George P. Kontoudis**, Stephen Krauss, Daniel J. Stilwell, “Model-Based Learning of Underwater Acoustic Communication Performance for Marine Robots,” *Robotics and Autonomous Systems*, 2021.
- [3] Geng Gao, Mojtaba Shahmohammadi, Lucas Gerez, **George P. Kontoudis**, Minas Liarokapis, “On Differential Mechanisms for Underactuated, Lightweight, Adaptive Prosthetic Hands,” *Frontiers in Neurorobotics*, 2021.
- [2] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Kinodynamic Motion Planning with Continuous-Time Q-Learning: An Online, Model-Free, and Safe Navigation Framework,” *IEEE Transactions on Neural Networks and Learning Systems*, 2019.
- [1] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, Tomonari Furukawa, “An Adaptive Actuation Mechanism for Anthropomorphic Robot Hands,” *Frontiers in Robotics and AI*, 2019.

### Chapters in Edited Volumes (BC)

- [1] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, Zirui Xu<sup>\*</sup>, “RRT-QX: Real-Time Kinodynamic Motion Planning in Dynamic Environments with Continuous-Time Reinforcement Learning,” in *Brain and Cognitive Intelligence: Control in Robotics*, B. Wei (Ed.), Taylor & Francis Group, CRC Press, 2022.

### Conference Papers Under Review (C:UR)

- [1] Alkesh K. Srivastava<sup>\*</sup>, **George P. Kontoudis**, Donald Sofge, Michael Otte, “Hazard Detection in Communication-Denied Environments using Bayesian Network Modeling of Path-Based Sensors.”

### Referred Conference Publications (C)

- [17] **George P. Kontoudis**, Daniel J. Stilwell, “Decentralized Federated Learning using Gaussian Processes,” *IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*, Boston, USA, 2023.

- [16] **George P. Kontoudis**, Michael Otte, “Adaptive Exploration-Exploitation Active Learning of Gaussian Processes,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Detroit, USA, 2023.
- [15] **George P. Kontoudis**, Michael Otte, “Closed-Form Active Learning of Expected Variance Reduction using Gaussian Process Surrogates for Adaptive Sampling,” *American Control Conference (ACC)*, San Diego, USA, 2023.
- [14] Alkesh K. Srivastava\*, **George P. Kontoudis**, Donald Sofge, Michael Otte, “Distributed Multi-Robot Information Gathering using Path-Based Sensors in Entropy-Weighted Voronoi Regions,” *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, Montbéliard, France, 2022. (Also appears as a chapter in the book: *Distributed Autonomous Robotic Systems*, Springer Tracts in Advanced Robotics, p. 286–299. 2024.)
- [13] Christos N. Mavridis, **George P. Kontoudis**, John S. Baras, “Sparse Gaussian Process Regression using Progressively Growing Learning Representations,” *IEEE Conference on Decision and Control (CDC)*, Cancun, Mexico, 2022.
- [12] Josh Netter\*, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Bounded Rational RRT-QX: Multi-Agent Motion Planning in Dynamic Human-Like Environments Using Cognitive Hierarchy and Q-Learning,” *IEEE Conference on Decision and Control (CDC)*, Austin, USA, 2021.
- [11] **George P. Kontoudis**, Daniel J. Stilwell, “Decentralized Nested Gaussian Processes for Multi-Robot Systems,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021.
- [10] Minas Liarokapis, **George P. Kontoudis**, “Teaching Robotic and Biomechatronic Concepts with a Gripper Design Project and a Grasping and Manipulation Competition,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021.
- [9] **George P. Kontoudis**, Daniel J. Stilwell, “Prediction of Acoustic Communication Performance in Marine Robots Using Model-Based Kriging,” *American Control Conference (ACC)*, New Orleans, USA, 2021.
- [8] Gal Gorjup, **George P. Kontoudis**, Anany Dwivedi, Geng Gao, Saori Matsunaga, Toshisada Mariyama, Bruce MacDonald, and Minas Liarokapis “Combining Programming by Demonstration with Path Optimization and Local Replanning to Facilitate the Execution of Assembly Tasks,” *IEEE International Conference on Systems, Man and Cybernetics (SMC)*, Toronto, Canada, 2020.
- [7] **George P. Kontoudis**, Zirui Xu\*, Kyriakos G. Vamvoudakis, “Online, Model-Free Motion Planning in Dynamic Environments: An Intermittent, Finite Horizon Approach with Continuous-Time Q-Learning,” *American Control Conference (ACC)*, Denver, USA, 2020.
- [6] **George P. Kontoudis**, Daniel J. Stilwell, “A Comparison of Kriging and Cokriging for Estimation of Underwater Acoustic Communication Performance,” *ACM International Conference on Underwater Networks and Systems (WuWNet)*, Atlanta, USA, 2019.
- [5] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, “An Adaptive, Humanlike Robot Hand with Selective Interdigitation: Towards Robust Grasping and Dexterous, In-Hand Manipulation,” *IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019.
- [4] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, “A Compliant, Underactuated Finger for Anthropomorphic Hands,” *IEEE/RAS-EMBS Inter. Conference on Rehabilitation Robotics (ICORR)*, Toronto, Canada, 2019.
- [3] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Robust Kinodynamic Motion Planning using Model-Free Game-Theoretic Learning,” *American Control Conference (ACC)*, Philadelphia, USA, 2019.
- [2] Kyriakos D. Tsoukalas, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Active-Bayesian Learning for Cooperation Connectivity in Dynamic Cyber-Physical-Human Systems,” *IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL)*, Honolulu, USA, 2017.
- [1] **George P. Kontoudis**, Minas Liarokapis, Agisilaos G. Zisimatos, Christoforos I. Mavrogiannis, Kostas J. Kyriakopoulos, “Open-Source, Anthropomorphic, Underactuated Robot Hands with a Selectively Lockable Differential Mechanism: Towards Affordable Prostheses,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Hamburg, Germany, 2015.

## Preprints (P)

- [1] **George P. Kontoudis**, Daniel J. Stilwell, “Fully Decentralized, Scalable Gaussian Processes for Multi-Agent Federated Learning,” *arXiv preprint, arXiv:2203.02865*, 2022.

## Referred Workshop Publications (W)

- [2] Alkesh K. Srivastava\*, **George P. Kontoudis**, Donald Sofge, Michael Otte, “Path-Based Sensors: Will the Knowledge of Correlation in Random Variables Accelerate Information Gathering?” *IEEE International Conference on Robotics and Automation (ICRA), Workshop on Communication Challenges in Multi-Robot Systems: Perception, Coordination, and Learning*, London, UK, June 2023.
- [1] **George P. Kontoudis**, “Scalable Multi-Robot Active Exploration,” *Robotics: Science and Systems (RSS), Pioneers Workshop*, New York City, USA, June 2022.

## Theses (T)

- [3] **George P. Kontoudis**, “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration,” *Doctoral Dissertation, Virginia Tech*, USA, December 2021.
- [2] **George P. Kontoudis**, “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation,” *Master Thesis, Virginia Tech*, USA, December 2018.
- [1] **George P. Kontoudis**, “Design and Development of an Underactuated, Anthropomorphic Robot Hand,” *Diploma Thesis, National Technical University of Athens*, March 2016. (in Greek)

## Technical Reports (TR)

- [2] **George P. Kontoudis**, Minas Liarokapis, Agisilaos G. Zisimatos, Christoforos I. Mavrogiannis, Kostas J. Kyriakopoulos, “How to Create Affordable, Anthropomorphic, Light-Weight Prosthetic Hands,” *Control Systems Lab, National Technical University of Athens*, Athens, Greece, October 2015.
- [1] Agisilaos G. Zisimatos, Minas Liarokapis, Christoforos I. Mavrogiannis, **George P. Kontoudis**, Kostas J. Kyriakopoulos, “How to Create Affordable, Modular, Light-Weight, Underactuated, Compliant Robot Hand,” *Control Systems Lab, National Technical University of Athens*, Athens, Greece, January 2015.

## SPONSORED RESEARCH PROJECTS

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### External (Current)

- “Development of Next-Generation Dynamically Adaptive Orthoses for Distal Extremity Injury,” *Naval Medical Center San Diego*. PI: Anthony Petrella. Co-PIs: Carl Frick, Andrew Petruska, George P. Kontoudis. \$850,062. Duration: 06/2023–06/2027.

## TALKS & PRESENTATIONS

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- “Decentralized Informative Path Planning with Gaussian Processes,” *NSF FRR-NRI PI Meeting*, Baltimore, USA, 2024. [Poster Presentation]
- “Optimal Kinodynamic Motion Planning and Informative Path Planning,” *Computer Science and Robotics Seminar, Colorado School of Mines*, Golden, USA, 2024. [Oral Presentation]
- “Decentralized Federated Learning using Gaussian Processes,” *IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*, Boston, USA, 2023. [Oral Presentation]
- “Adaptive Exploration-Exploitation Active Learning of Gaussian Processes,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Detroit, USA, 2023. [Oral & Poster Presentation]
- “Closed-Form Active Learning Using Expected Variance Reduction of Gaussian Process Surrogates for Adaptive Sampling” *American Control Conference (ACC)*, San Diego, USA, 2023. [Oral Presentation]
- “Decentralized Gaussian Process Learning for Exploration with Multi-Robot Systems” *Maryland Robotics Center Research Symposium*, College Park, USA, May 2023. [Oral Presentation - Invited Talk]
- “Scalable Exploration-Exploitation Active Learning of Gaussian Process Surrogates for Adaptive Sampling” *Maryland Robotics Center Research Symposium*, College Park, USA, May 2023. [Poster Presentation]
- “Multi-Robot Adaptive Sampling using Decentralized Gaussian Processes,” *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, Monbeliard, France, November 2022. [Poster Presentation]
- “Scalable Multi-Robot Active Exploration,” *Robotics: Science and Systems (RSS), Pioneers Workshop*, New York City, USA, June 2022. [Spotlight Presentation]
- “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration” *Bradley Department of Electrical and Computer Engineering, Virginia Tech*, Blacksburg, USA, December 2021. [PhD Defense]

- “Decentralized Nested Gaussian Processes for Multi-Robot Systems,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021. [**Virtual Presentation**]
- “Online, Model-Free Motion Planning in Dynamic Environments: An Intermittent, Finite Horizon Approach with Continuous-Time Q-Learning,” *American Control Conference (ACC)*, Denver, USA, 2020. [**Rapid-Interactive Presentation**]
- “A Comparison of Kriging and Cokriging for Estimation of Underwater Acoustic Communication Performance,” *ACM International Conference on Underwater Networks and Systems (WuWNet)*, Atlanta, USA, 2019. [**Oral Presentation**]
- “An Adaptive, Humanlike Robot Hand with Selective Interdigitation: Towards Robust Grasping and Dexterous, In-Hand Manipulation,” *IEEE-RAS Intern. Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019. [**Poster Presentation**]
- “Robust Kinodynamic Motion Planning using Model-Free Game-Theoretic Learning,” *American Control Conference (ACC)*, Philadelphia, USA, 2019. [**Oral Presentation**]
- “A Compliant, Underactuated Finger for Anthropomorphic Hands,” *IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR)*, Toronto, Canada, 2019. [**Poster Presentation**]
- “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation,” *Department of Mechanical Engineering, Virginia Tech*, Blacksburg, USA, December 2018. [**Master’s Defense**]
- “Evaluation Strategies of Adaptive, Anthropomorphic Robot Hands for Dexterous In-Hand Manipulation: Early Results,” *National Institute of Standards and Technology (NIST)*, USA, 2018. [**Invited Talk**]
- “Open-Source, Anthropomorphic, Underactuated Robot Hands with a Selectively Lockable Differential Mechanism: Towards Affordable Prostheses,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Hamburg, Germany, 2015. [**Oral Presentation**]

## SERVICE ACTIVITIES

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### Conference Committees

- Program Committee Member, Australasian Conference on Robotics and Automation (ACRA) 2024
- General Chair, Robotics: Science and Systems (RSS), Pioneers Workshop 2023
- Program Committee Member, Conference on Artificial Intelligence (AAAI), Student Abstract and Poster 2023, 2024
- Online Platform Chair, Conference on Robot Learning (CoRL) 2022

### Associate Editor

- IEEE International Conference on Robotics and Automation (ICRA) 2025

### Reviewer

- **Journals:** IEEE Transactions on Neural Networks and Learning Systems (TNNLS) · IEEE Transactions on Robotics (TRO) · IEEE Transactions on Automatic Control (TAC) · IEEE Transactions on Automation Science and Engineering (TASE) · IEEE Robotics and Automation Letters (RAL) · IEEE Control Systems Letters (CSL) · IEEE Robotics & Automation Magazine (RAM) · Autonomous Robots (AURO) · IEEE Journal of Oceanic Engineering (JOE) · IEEE Transactions on Systems, Man and Cybernetics: Systems (TSMCA) · IEEE Transactions on Cybernetics · IEEE Computational Intelligence Magazine (CIM) · Frontiers in Robotics and AI (FROBAI) · Frontiers in Artificial Intelligence (FAI) · Journal of Optimization Theory and Applications (JOTA) · International Journal of Advanced Robotic Systems (IJARS)
- **Conferences:** IEEE International Conference on Robotics and Automation (ICRA) · IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) · Robotics: Science and Systems (RSS) · American Control Conference (ACC) · IEEE Conference on Decision and Control (CDC) · International Symposium on Distributed Autonomous Robotic Systems (DARS) · IEEE Conference on Control Technology and Applications (CCTA) · International Conference on Ubiquitous Robots (UR) · IEEE International Conference on Automation Science and Engineering (CASE) · IEEE-RAS International Conference on Humanoid Robots (Humanoids) · European Control Conference (ECC) · IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob) · Mediterranean Conference on Control and Automation (MED)

### Colorado School of Mines Committees

- Committee member, Graduate Applications Committee 2024–present
- **Judge:** Graduate Research and Discovery Symposium (GRADS) - S ’24 · Mines Capstone Design Senior Showcase - S ’24 · Undergraduate Research Symposium - F ’24

## RESEARCH ADVISING

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### PhD Students

- Sanket Salunkhe, Colorado School of Mines 2024–present
- Mykola Mazur, Colorado School of Mines (*co-advised with Anthony Petrella*) 2024–present
- **Joshua Netter**, Georgia Institute of Technology 2020–2023  
Publications: C-[12], J:UR-[2]

### Master's Students

- **Alkesh K. Srivastava**, University of Maryland 2022–2023  
Publications: C-[14], W-[2], C:UR-[1]
- **Zirui Xu**, Georgia Institute of Technology 2018–2020  
Publications: C-[7], BC-[1], J-[5]

### Undergraduate Students

- Ross Hodson (SURF and MURF Scholar), Colorado School of Mines 2024–present
- Remi Jones, Colorado School of Mines 2024–present  
Awards: 2nd place for poster presentation in Fall Undergraduate Research Symposium at Mines
- Elijah Paiz, Colorado School of Mines 2024–present  
Awards: 2nd place for poster presentation in Fall Undergraduate Research Symposium at Mines

### PhD Students - Dissertation Committee Member

- Matthew Stanley, PhD student in Mechanical Engineering, Colorado School of Mines 2024–present

### PhD Students - Qualifying Exam Committee Member

- Kazi Rifat Bin Rafiq, PhD student in Mechanical Engineering, Colorado School of Mines Spring 2024
- James Verheyden, PhD student in Mechanical Engineering, Colorado School of Mines Spring 2024
- Eugene Hamzezadeh, PhD student in Robotics, Colorado School of Mines Fall 2024
- Seth Stewart, PhD student in Robotics, Colorado School of Mines Fall 2024