Antony Thomas

NOCC Lab, Pad E, Floor 2, DIBRIS, University of Genoa, Genoa 16145, Italy

EDUCATION

DIBRIS − University of Genoa, Genoa, Italy

Doctor of Philosophy (PhD) in
Robotics and Autonomous Systems   Nov 2017 − Jul 2021
Advisers: Prof. Marco Baglietto & Prof. Fulvio Mastrogiovanni
Thesis: *Multimodal Planning under Uncertainty: Task-Motion Planning and Collision Avoidance*
Research areas: Integrated Task and Motion Planning, Planning under Uncertainty, Collision Probability

Technion − Israel Institute of Technology, Haifa, Israel

Master of Science (MSc) in
Aerospace Engineering   Mar 2015 − Mar 2017
Adviser: Prof. Vadim Indelman
Thesis: *Incorporating Data Association Within Belief Space Planning For Robust Autonomous Navigation*
Research areas: Belief Space Planning, Data Association.

Indian Institute of Technology, Madras, Chennai, India

B.Tech and M.Tech (Dual Degree) in
Aerospace Engineering   Aug 2009 − Jun 2014
Adviser: Prof. Nandan Kumar Sinha
Thesis: *Perching in F-18 and the Applications of Aircraft Design Code*
Research areas: Bifurcation theory for aircraft design and stability.

RESEARCH INTERESTS

AI planning, integrated task and motion planning, belief-space planning, multi-robot planning.

PUBLICATIONS

Journal Papers

7) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Safe Motion Planning with Environment Uncertainty", in *Robotics and Autonomous Systems*, **under review**.

6) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Exact and Bounded Collision Probability for Motion Planning Under Gaussian Uncertainty", in *IEEE Robotics and Automation Letters*, 7(1): 167-174, 2022. https://doi.org/10.1109/LRA.2021.3121073

5) M. H. Tanveer, <u>A. Thomas</u>, W. Ahmed, Z. Hongxiao. "Estimate the Unknown Environment with Biosonar Echoes—A Simulation Study", in *Sensors*, 21(12), 4186, 2021. https://www.mdpi.com/1424-8220/21/12/4186

4) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "MPTP: Motion-Planning-aware Task Planning for Navigation in Belief Space", in *Robotics and Autonomous Systems*, 141:103786, 2021. https://doi.org/10.1016/j.robot.2021.103786

3) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "An Integrated Localisation, Motion Planning and Obstacle Avoidance Algorithm in Belief Space", in *Intelligent Service Robotics*, 14(2):235-250, 2021. https://doi.org/10.1007/s11370-021-00359-6

2) M. H. Tanveer, X. Wu, <u>A. Thomas</u>, C. Ming, R. Müller, P. Tokekar, Z. Hongxiao. "A Simulation Framework for Bio-inspired Sonar Sensing with Unmanned Aerial Vehicles", in *PLoS ONE*, 15(11): e0241443, 2020. https://doi.org/10.1371/journal.pone.0241443

1) S. Pathak, <u>A. Thomas</u> and V. Indelman. "A Unified Framework for Data Association Aware Robust Belief Space Planning and Perception", in *International Journal of Robotics Research (IJRR)*, 37(2-3):287-315, 2018. http://dx.doi.org/10.1177/0278364918759606

Conference Papers

16) H. Karami, <u>A. Thomas</u>, F. Mastrogiovanni. "Task Allocation for Multi-Robot Task and Motion Planning:a case for Object Picking in Cluttered Workspaces," in *International Conference of the Italian Association for Artificial Intelligence (AI×IA)*, Milano, Italy, December 2021.

15) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Probabilistic Collision Constraint for Motion Planning in Dynamic Environments," in *International Conference on Intelligent Autonomous Systems (IAS)*, Singapore, June 2021.

14) M. H. Tanveer, Z. Hongxiao, W. Ahmed, <u>A. Thomas</u>, B. M. Imran, M. Salman. "Mel-spectrogram and Deep CNN based Representation Learning from Bio-Sonar Implementation on UAVs," in *International Conference on Computer, Control and Robotics (ICCCR)*, Shanghai, China, January 2021.

13) M. H. Tanveer, M. Sabbagh, <u>A. Thomas</u>, B. M. Imran, M. H. Soomro. "RNN and Mel-spectrogram based acoustic balancing and bouncing of plastic ball," in *IEEE International Conference on Computing, Networking, Telecommunications & Engineering Sciences Applications 2020 (CoNTESA)*, Epoka University, Tirana, Albania, USA, December 2020.

12) M. Sabbagh, M. H. Tanveer, <u>A. Thomas</u>, M. Salman, J. Faile. "Real Time Voronoi-like Path Planning Using Flow Field and A*," in *IEEE International Conference on Smart Communities: Improving Quality of Life Using ICT, IoT and AI (HONET)*, Charlotte, NC, USA, December 2020.

11) <u>A. Thomas</u>, H. Karami, F. Mastrogiovanni. "Iterative AND/OR Graphs for Task-Motion Planning," in *Italian Conference on Robotics and Intelligent Machines (I-RIM)*, Rome, Italy, December 2020.

10) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Motion Planning with Environment Uncertainty," in *Italian Conference on Robotics and Intelligent Machines (I-RIM)*, Rome, Italy, December 2020.

9) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Towards Multi-Robot Task-Motion Planning for Navigation in Belief Space," in *European Starting AI Researchers' Symposium (STAIRS)*, Santiago de Compostela, Spain, August 2020.

8) M. H. Tanveer, <u>A. Thomas</u>, R. Müller, P. Tokekar, X. Wu, Z. Hongxiao. "Recreating Bat Behavior on Quad-rotor UAVs–A Simulation Approach," in *International Florida AI Research Society (FLAIRS) Conference*, North Miami Beach, Florida, USA, May 2020.

7) M. H. Tanveer, <u>A. Thomas</u>, X. Wu, Z. Hongxiao. "Simulate forest trees by integrating L-system and 3D CAD files," in *International Conference on Information and Computer Technologies (ICICT)*, Silicon Valley, San Jose, USA, March 2020.

6) <u>A. Thomas</u>, F. Mastrogiovanni, M. Baglietto. "Task-Motion Planning for Navigation in Belief Space," in *The International Symposium on Robotics Research (ISRR)*, Hanoi, Vietnam, October 2019.

5) <u>A. Thomas</u>, S. Amatya, F. Mastrogiovanni, M. Baglietto. "Task-assisted Motion Planning in Belief Space," in *Italian Conference on Robotics and Intelligent Machines (I-RIM)*, Rome, Italy, October 2019.

4) S. Pathak, <u>A. Thomas</u> and V. Indelman. "Nonmyopic Data Association Aware Belief Space Planning for Robust Active Perception," in *International Conference on Robotics and Automation (ICRA)*, Singapore, May 2017.

3) S. Pathak, <u>A. Thomas</u>, A. Feniger, and V. Indelman. "DA-BSP: Towards Data Association Aware Be-lief Space Planning for Robust Active Perception," in *European Conference on Artificial Intelligence (ECAI)*, The Hague, Netherlands, September 2016.

2) S. Pathak, <u>A. Thomas</u>, A. Feniger, and V. Indelman. "Robust Active Perception for Belief Space Planning in Perceptually Aliased and Uncertain Environments," in *The Israeli Conference on Robotics (ICR)*, Herzliya, Israel, April 2016.

1) A. Thomas, A. Khatri, and N. K. Sinha. "Conceptual Design for MAV Maneuvers," in *3rd International Conference on Recent Advances in Design, Development and Operation of Micro Air Vehicles (ICRAMAV)*, Elsevier, JNTUH, Hyderabad, India, November 2014.

Book Chapters

1) M.H. Tanveer, A. Sgorbissa, A. Thomas. "An IPM Approach to Multi-robot Cooperative Localization: Pepper Humanoid and Wheeled Robots in a Shared Space," in *15th International Conference, ICINCO 2018, Porto, Portugal, July 29-31, 2018, Revised Selected Papers*, Volume 613, 429-447, Springer International Publishing, 2020.

Workshop and Symposium Papers

3) A. Thomas, S. Amatya, F. Mastrogiovanni, M. Baglietto. "Towards Perception Aware Task-Motion Planning," in *Reasoning and Learning in Real-World Systems for Long-Term Autonomy, AAAI Fall Symposium*, Arlington, VA, USA, October 2018.

2) A. Thomas, S. Amatya, F. Mastrogiovanni, M. Baglietto. "Task-Motion Planning in Belief Space," in *RSS Workshop on Exhibition and Benchmarking of Task and Motion Planners*, Carnegie Mellon University, Pittsburgh, PA, USA, June 2018.

1) S. Pathak, A. Thomas, A. Feniger, and V. Indelman. "Towards data association aware belief space planning for robust active perception," in *AI for Long-term Autonomy, workshop in conjunction with IEEE International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden, May 2016.

Technical Reports

3) H. Karami, A. Thomas, F. Mastrogiovanni. "A Task-Motion Planning Framework Using Iteratively Deepened AND/OR Graph Networks," *arXiv:2104.01549*, April 2021.

2) A. Thomas, S. Amatya, F. Mastrogiovanni, M. Baglietto. "Task-assisted Motion Planning in Partially Observable Domains," *arXiv:1908.10227*, August 2019.

1) S. Pathak, A. Thomas, A. Feniger, and V. Indelman. "Robust Active Perception via Data-association aware Belief Space Planning," *arXiv:1606.05124*, June 2016.

TALKS & POSTERS	International Conference of the Italian Association for Artificial Intelligence (AIxIA), December 2021. **Talk:** Task Allocation for Multi-Robot Task and Motion Planning:a case for Object Picking in Cluttered Workspaces.
	International Conference on Intelligent Autonomous Systems (IAS), June 2021. **Talk:** Probabilistic Collision Constraint for Motion Planning in Dynamic Environments.
	Italian Conference on Robotics and Intelligent Machines (I-RIM), October 2020. **Talk:** Motion Planning with Environment Uncertainty.
	European Starting AI Researchers' Symposium (STAIRS), August 2020. **Talk:** Towards Multi-Robot Task-Motion Planning for Navigation in Belief Space.
	Italian Conference on Robotics and Intelligent Machines (I-RIM), October 2019. **Poster:** Task-assisted Motion Planning in Belief Space.
	The International Symposium on Robotics Research (ISRR), October 2019. **Talk:** Task-Motion Planning for Navigation in Belief Space.
	AAAI Fall Symposium, October 2018. **Talk:** Task-Motion Planning in Belief Space.
	The Israeli Conference on Robotics (ICR), April 2016. **Talk:** Robust Active Perception for Belief Space Planning in Perceptually Aliased and Uncertain Environments.
PATENTS	Nonmyopic Data Association Aware Belief Space Planning for Robust Active Perception (co-inventor). Patent number: US 10,940,587.

MASTER THESIS CO-SUPERVISED	Suman Pal. "Deep Reinforcement Learning in Dynamic POMDP Environments," *European Master on Advanced RObotics (EMARO+).* Jan 2019 – Aug 2019
	Luigi Secondo. "Task-Motion planning for inspection and maintenance robots performing spacecraft extravehicular activities," *European Master on Advanced RObotics (EMARO+).* Jan 2019 – Aug 2019
	Sunny Amatya. "External advisors for combined task and motion planning in belief space," *European Master on Advanced RObotics (EMARO+).* Jan 2018 – Aug 2018
ACADEMIC ACTIVITIES & SERVICE	Session co-chair at the International Conference on Intelligent Autonomous Systems (IAS), 2021; *Navigation (I)*
	Reviewing IEEE International Conference on Robotics and Automation (ICRA), Cognitive Systems Research, European Control Conference (ECC), American Control Conference (ACC), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE Conference on Decision and Control (CDC), International Symposium on Experimental Robotics (ISER), IEEE Robotics and Automation Letters (RA-L), Intelligent Service Robotics, IEEE Transactions on Robotics (T-RO)
ACADEMIC HONORS & AWARDS	Certificate of Outstanding Contribution in Reviewing, Cognitive Systems Research, November 2018. *In recognition of the contributions made to the quality of the journal.*
	The ICAPS Summer School, Noordwijk, Netherlands, June 20 - 23, 2018. *Theme: planning under uncertainty.*
	The Leonard and Diane Sherman Interdisciplinary Graduate School Fellowship (2016) Technion – Israel Institute of Technology. *For distinguished academic achievements.*
	Varuna Merit Award (2007,2008) Bhavan's Varuna Vidyalaya, Thrikkakara, India. *For being the school topper in mathematics in the eleventh standard (2007) and twelfth standard (2008) CBSE board examinations.*
TEACHING & MENTORING EXPERIENCE	Invited lecturer for the masters level course *AI for Robotics II* instructed by Prof. Fulvio Mastrogiovanni. University of Genoa, Italy, 2021. Lecture on task-motion planning, creation and evaluation of assignment for the same.
	Assisting robotics students with *Software Architecture (SofAr)* course project. University of Genoa, Italy, 2019, 2020. Supervising student projects as a part of the robotics masters course of Prof. Fulvio Mastrogiovanni.
	Teaching Assistant for *Aerospace Structures* instructed by Prof. H.S.N. Murthy. IIT Madras, Chennai, Aug 2013- Dec 2013. Attended by undergraduate students. Conducting problem-solving sessions, and correcting assignments were the tasks.
	Demo session of the continuation software, AUTO. IIT Madras, Chennai, Nov 2014. Attended by undergraduate and graduate students as part of the course *Advanced Flight Mechanics* instructed by Prof. Nandan Kumar Sinha.
MEDIA COVERAGE	[Bat behavior in quad-rotor UAVs](#) Tech Xplore, Mar 2020
SCHOLASTIC & PERSONAL ACHIEVEMENTS	All India Rank of 150 in National Science Olympiad 2007 conducted by Science Olympiad Foundation.
	Obtained a rank of 5 in Math Talent Search Examination 2006 conducted by Kerala Ganitha Sastra Parishad, Kerala, India.

Twice recipient of Shri C. Subramaniam award for excellence in character from among the pupils of Std. V-VIII (2003-04) and XI-XII(2007-2008), awarded by Bharatiya Vidya Bhavan, India.

LANGUAGES   Malayalam: Native language.
English: Fluent (speaking, reading, writing).
Hindi: Intermediate (reading, speaking, writing).

SKILLS   LaTeX, MATLAB, C++, Python, GAZEBO, ROS, AUTO2000/07.