

## Santhakumar Mohan, Ph. D. (IIT Madras)

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Associate Professor, Mechanical Engineering  
#122, Indian Institute of Technology Palakkad  
Ahalia Integrated Campus,  
Palakkad, Kozhippara, Kerala 678557, India  
Mobile: +91-8602-972799 Office: +91-4923-226-434  
Email: [santhakumar@iitpkd.ac.in](mailto:santhakumar@iitpkd.ac.in) and [santharadha@gmail.com](mailto:santharadha@gmail.com)  
Webpage: <https://iitpkd.ac.in/people/santhakumar>



### Research Interests

Broadly, I work in the field of Robotics and Control. Specifically, I have research interests as follows:

- Field Robotics, Mobile Manipulators and Underwater Robotic Systems (Dynamics and Control)
- Assistive and Rehabilitation Robots (Lower Limb Rehabilitation Robots)
- Parallel Robotic Platforms (Mechanical Design, Dynamics and Control)

### Academic Preparation

Ph. D. in Engineering Design (Specialisation in Robotics and Control)

Indian Institute of Technology Madras, Chennai, India 2007-2010

Advisor: Prof. T. Asokan

Dissertation: Investigations on trajectory tracking and dynamic station keeping control of an underactuated flatfish type autonomous underwater robotic vehicle.

M. E. in Mechanical Engineering (Specialisation in Manufacturing Engineering)

Government College of Technology, Coimbatore, India 2003-2005

Advisor: Prof. P.K. Jayadev

Thesis: Kinematic calibration and optimum path planning of a SCORA ER 14 (SCARA) robotic manipulator using vision system.

B. E. in Mechanical Engineering

Government of College of Engineering, Salem, India 1999-2003

Advisor: Prof. R. Marappan

Project: Design and development of a vehicle manipulator system and implementation of an ultrasonic sensor for an exploration task.

### Professional Experience

#### Regular positions

Associate Professor, Indian Institute of Technology Palakkad, INDIA Dec. 2018 – present

Associate Professor, Indian Institute of Technology Indore, INDIA May 2017 – Dec. 2018

Alexander von Humboldt Research Fellowship, RWTH Aachen, GERMANY May 2016 – May 2017

Project coordinator, Belgorod State Technological University, Russia, Aug. 2019 - present

Assistant Professor, Indian Institute of Technology Indore, INDIA Mar. 2012 - May 2017

Postdoctoral Research Fellow, KAIST, Daejeon, ROK Mar. 2011 - Mar. 2012

Assistant Professor, National Institute of Technology Calicut, INDIA Jul. 2010 - Mar. 2011

Teaching Assistant, Indian Institute of Technology Madras, INDIA Jan. 2007 - Jul. 2010

#### Visiting positions

Visiting Professor, Ecole Centrale de Nantes, FRANCE April 2017 and May 2019

Visiting Faculty, ME, Indian Institute of Science, Bangalore, INDIA May - Jun. 2015

Visiting Assistant Professor, C-FRIEND, KAIST, Daejeon, ROK Dec., 2014, July - Aug. 2015

Visiting Assistant Professor, ORIN, OSE, KAIST, Daejeon, ROK May - Jun. 2013

Visiting Professor, PSG College of Technology, Coimbatore, INDIA Dec. 2013 - present

## Honours and Awards

- Received the Alexander von Humboldt research fellowship from Alexander von Humboldt Foundation, GERMANY 2016-2017
- Received the European Master on Advanced Robotics Plus (EMARO+) fellowship from Erasmus Mundus, FRANCE 2018-19
- Satellite Across Virtual Institute (SAVI) research fellowship from National Research Foundation, ROK 2013-2015
- Outstanding Young Scientist Award from Korea Robotics Society (KROS), ROK 2014
- Best Teacher (Academic Excellence) Award from IIT Indore, India 2013
- Received the World Class University (WCU) and the Brain Korea (BK21) fellowships to conduct research at KAIST, Daejeon, ROK 2011-2012
- Awarded National Doctoral Fellowship (NDF) from AICTE, New Delhi, 2007
- Gold Medal (Memorial Award) from Government of College of Engineering, Salem, India 2003

## Sponsored Research Projects

Project Title	Agency	Status and Role	Budget	Outcomes
Design and Development of a new sitting-type lower limb rehabilitation robot	Council of Scientific and Industrial Research (CSIR), India	Ongoing (2020-2022) PI	Rs. 23.21 Lacs	1 MS student pursuing 1 book chapter
Bio-inspired Hybrid Underwater Vehicle for Ocean Observations	Science and Engineering Research Board (SERB), India	Ongoing (2019-2022) PI	Rs. 28.85 Lacs	1 PhD student pursuing
Development of a hybrid robotic system based on a passive orthosis and an active parallel manipulator for the lower limb rehabilitation	Russian Science Foundation (RSF), Russia	Ongoing (2019-2021) PI (joint project)	Rs. 180 Lacs	1 MS student pursuing 5 book chapters
Robust motion control design for an underwater robot with tilting thrusters	Department of Science and Technology (DST), India and National Research Foundation (NRF), Republic of Korea	Ongoing (2018-2021) PI (Joint Project)	Rs. 25.14 Lacs Total: Rs. 125 Lacs	1 Indian Patent published 3 SCI Journal papers 2 PhD students pursuing
Teaching Learning Centre on "Internet of Things"	Department of Higher Education (DHE), India	Completed (2016-2020) PI (Consortium Project)	Rs. 143 Lacs Total: Rs. 758 Lacs	4 SCI Journal papers 1 PhD student completed
Design and development of an economical, lightweight and multi-purpose four degrees of freedom hybrid robotic motion platform	Council of Scientific and Industrial Research (CSIR), India	Completed (2016-2019) PI	Rs. 18.96 Lacs	4 SCI Journal papers 1 Indian Patent published 1 PhD student completed

Development of an underwater robotic research platform for the autonomous control and manipulation tasks	National Research Foundation (NRF), Republic of Korea	Completed (2013-2015) PI	Rs. 16 Lacs	3 SCI Journal papers 1 MS student completed
Design, development and control of a new three degrees of freedom (3-dof) parallel robot for x-y theta ( $xy\theta_z$ ) motion	Science and Engineering Research Board (SERB), India	Completed (2012-2015) PI	Rs. 13.32 Lacs	5 SCI Journal papers 1 Indian Patent published 1 PhD student completed
Design of a popup antenna system for intermittent communication of an observed underwater noise and which remains submerged otherwise	Naval Research Board (NRB), India	Completed (2012-2014) Co-PI	Rs. 14.86Lacs	2 SCI Journal papers 1 PhD student completed
Development and control of a kinematically redundant tele-operated mobile manipulator for mining / rescue operations	Technology System Development Program, Department of Science and Technology (DST), India	Approved in 2016 PI (Joint Project with IITK)	Rs. 87 Lacs Total: Rs. 165 Lacs	We have withdrawn it due to other official commitments

### Summary of Publications

1. Journal Papers/articles: 48 (Published) + 1 (in press, online version available)
2. Patents: 4 (Indian Patents, Published)
3. Edited Book (as an Editor): 2 (Published) + 1 (in press)
4. Book Chapters: 14 (Published) + 6 (in press)
5. International Conferences: 63

### Patents

1. **Santhakumar Mohan** and Yogesh Singh, A MECHANISM OF 2PRP-PRR PLANAR PARALLEL MANIPULATOR AND A METHOD THEREOF, India, 4678/MUM/2015, 2015 (Published, The Patent Office Journal No. 24/2017 Dated 16/06/2017 page 20581)
2. **Santhakumar Mohan** and Jayant Kumar Mohanta, A REHABILITATION ROBOT FOR LOWER LIMB GAIT THERAPY, India, 4757/MUM/2015, 2015 (Published, The Patent Office Journal No. 25/2017 Dated 23/06/2017 page 21372)
3. **Santhakumar Mohan** and Jayant Kumar Mohanta, SIX DEGREE OF FREEDOM PARALLEL MANIPULATOR IN RPRS CONFIGURATION, India, 201621019170, 2016 (Published, The Patent Office Journal No. 49/2017 Dated 08/12/2017 page 47906)
4. Jagadeesh Kadiyam and **Santhakumar Mohan**, HYBRID UNDERWATER VEHICLE FOR OCEAN OBSERVATIONS, India, 201821009575, 2018 (Published, The Patent Office Journal No. 14/2018 Dated 06/04/2018 page 12088)

### Selected Refereed Journal Publications

(SCOPUS Author ID: 26434501600)

#### Published/in press (Science Citation Indexed (SCI) journals)

1. Ravi Prakash, Laxmidhar Behera, **Santhakumar Mohan**, Jagannathan Sarangapani, Dynamic Trajectory Generation and a Robust Controller to Intercept a Moving Ball in a Game Setting, IEEE Transactions on Control Systems Technology, in press (available online) 2019 (IF:4.883)

2. Jagadeesh Kadiyam, Anjali Parashar, **Santhakumar Mohan**, and Devendra Deshmukh, Actuator fault-tolerant control study of an underwater robot with four rotatable thrusters, *Ocean Engineering* 187, 1-19, 2020 (IF: 2.73)
3. Jagadeesh Kadiyam, **Santhakumar Mohan**, Conceptual design of a hybrid propulsion underwater robotic vehicle with different propulsion systems for ocean observations, *Ocean Engineering* 182, 112-125, 2019 (IF: 2.73)
4. Vasanthakumar M, Vinod B, JK Mohanta and Santhakumar Mohan, Design and Robust Motion Control of a Planar 1P-2PRP Hybrid Manipulator for Lower Limb Rehabilitation Applications, *Journal of Intelligent & Robotic Systems*, 96, 17-30 2019 (IF:2.02)
5. Jayant Kumar Mohanta, Yogesh Singh and **Santhakumar Mohan**, Kinematic and Dynamic Performance Investigations of Asymmetric (U-shaped fixed-based) Planar Parallel Manipulators, *Robotica*, 36, 1111-1143, 2018 (IF: 1.554)
6. Swati Mishra, Pandurang Londhe, **Santhakumar Mohan**, SK Vishwakarama and Balasaheb Patre, Robust task-space motion control of a mobile manipulator using a nonlinear control with an uncertainty estimator, *Computers and Electrical Engineering*, 67, 729-740, 2018 (IF: 2.189)
7. Balasaheb Patre, Pandurang Londhe, Laxman Waghmare and **Santhakumar Mohan**, Disturbance estimator based non-singular fast fuzzy terminal sliding mode control of an autonomous underwater vehicle, *Ocean Engineering*, 159, 372-387, 2018 (IF: 2.73)
8. **Santhakumar Mohan**, Error analysis and control scheme for the error correction in trajectory-tracking of a planar 2PRP-PPR parallel manipulator, *Mechatronics*, 46, 70-83, 2017 (IF: 2.978)
9. **Santhakumar Mohan** and Burkhard Corves, Inverse dynamics and trajectory tracking control of a new six degrees of freedom spatial 3-RPRS parallel manipulator, *Mechanical Sciences*, 8, 235-248, 2017 (IF: 1.211)
10. Anirban Nag, **Santhakumar Mohan** and Sandipan Bandyopadhyay, Forward Kinematic Analysis of the 3-RPRS Parallel Manipulator, *Mechanism and Machine Theory*, 116, 262-272, 2017 (IF: 3.535)
11. Pandurang Londhe, **Santhakumar Mohan**, Balasaheb Patre, and Laxman Waghmare, Robust Task-Space Control of an Autonomous Underwater Vehicle-Manipulator System by PID-like Fuzzy Control Scheme with Disturbance Estimator, *Ocean Engineering*, 139, 1-13, 2017 (IF: 2.73)
12. **Santhakumar Mohan**, J.K. Mohanta, S.Kurtenbach, J. Paris, B.Corves and M. Huesing, Design, development and control of a 2PRP-2PPR planar parallel manipulator for lower limb rehabilitation therapies, *Mechanism and Machine Theory*, 112, 272-294, 2017 (IF:3.535)
13. Pandurang Londhe, **Santhakumar Mohan**, Balasaheb Patre, and Laxman Waghmare, Task Space Control of an Autonomous Underwater Vehicle-Manipulator System by Robust Single-Input Fuzzy Logic Control Scheme, *IEEE Journal of Oceanic Engineering*, 42, 13-28, 2017 (IF: 2.297)
14. Pandurang S Londhe, Yogesh Singh, **Santhakumar Mohan**, Balasaheb Patre and Laxman M Waghmare, Robust Nonlinear PID-like Fuzzy Logic Control of a Planar Parallel (2PRP-PPR) Manipulator, *ISA Transactions*, 63, 218-232, 2016 (IF: 4.343)
15. **Santhakumar Mohan** and Jinwhan Kim, Coordinated motion control in task space of an autonomous underwater vehicle - manipulator system, *Ocean Engineering* 104, 155-167, 2015 (IF: 2.73)
16. Yogesh Singh and **Santhakumar Mohan**, Inverse dynamics and robust sliding mode control of a planar parallel (2-PRP and 1-PPR) robot augmented with a nonlinear disturbance observer, *Mechanism and Machine Theory* 92, 29-50, 2015 (IF: 3.535)
17. Yogesh Singh, V. Vinoth, Y.Ravi Kiran, Jayant Kumar Mohanta and **Santhakumar Mohan**, Inverse dynamics and control of a 3-DOF planar parallel robotic (U-Shaped 3-PPR) manipulator, *Robotics and Computer Integrated Manufacturing*, 34, 164-179, 2015. (IF: 4.392)
18. V.Vinoth, Yogesh Singh and **Santhakumar Mohan**, Indirect disturbance compensation control of a planar parallel (2-PRP and 1-PPR) robotic manipulator, *Robotics and Computer Integrated Manufacturing*, 30(5), 556-564, 2014 (IF: 4.392)

19. **Santhakumar Mohan** and T.Asokan, Power efficient dynamic station keeping control of an underactuated flat-fish type autonomous underwater vehicle through design modifications of thruster configuration. *Ocean Engineering* 58, 11-21, 2013 (IF: 2.73)
20. **Santhakumar Mohan** and Jinwhan Kim, Indirect adaptive control of an autonomous underwater vehicle-manipulator system for underwater manipulation tasks, *Ocean Engineering* 54, 233-243, 2012 (IF:2.73)

### **Edited Books (as an Editor)**

1. Dibakar Sen, **Santhakumar Mohan**, G.K. Ananthasuresh, *Mechanism and Machine Science, Select Proceedings of Asian MMS 2018, Lecture Notes in Mechanical Engineering*, Springer Singapore, 2020 DOI: 10.1007/978-981-15-4477-4, Hardcover ISBN: 978-981-15-4476-7
2. Neelesh Kumar Jain, I.A. Palani, B.K. Lad, **Santhakumar Mohan**, Anand Parey, *Robotics, Automation, Manufacturing and Industrial Engineering, Proceedings of 2nd International Conference on Intelligent Robotics, Automation and Manufacturing*, Emerald Group Publishing (India) Pvt. Ltd. New Delhi 2013 ISBN: 978-099-2680-015
3. **Santhakumar Mohan**, S. Shankar, G. Rajeshkumar, *Materials, Design, and Manufacturing for Sustainable Environment – Select Proceedings of ICMDMSE 2020*, Springer (in press)

### **Selected Refereed Book Chapters**

1. **Santhakumar Mohan**, J. K. Mohanta, B. Corves, M. Hüsing (2018) Dual-Loop Motion Control for Geometric Errors and Joint Clearances Compensation of a Planar 2-PRP+1-PPR Manipulator, *Mechanical Transmissions and Robotics, Mechanisms and Machine Science*, 52, pp 171-180.
2. **Santhakumar Mohan**, B. Corves, P. Wenger (2018) Design Optimization and Accuracy Analysis of a Planar 2PRP-PRR Parallel Manipulator, *Computational Kinematics, Mechanisms and Machine Science* 50, pp 432-440.
3. Gopi Krishnan Regularan, Ganesan Kaliappan, **Santhakumar Mohan**, (2016) Development of an Amphibian Legged Robot Based on Jansen Mechanism for Exploration Tasks, *Advancements in Automation, Robotics and Sensing, Communications in Computer and Information Science*, 627, pp 74-91

### **Selected Refereed Conference Publications**

1. J.K. Mohanta, **Santhakumar Mohan**, Y. Takeda, B. Corves, Adaptive Backstepping Motion Control of a New Sitting-type Lower Limb Rehabilitation Robot, *Advances in Mechanism and Machine Science. IFToMM WC 2019. Mechanisms and Machine Science 73 (Finalist, Best Paper Award) 2761-2768* (2019)
2. Muralidharan M, **Santhakumar Mohan**, Task-space pose decomposition motion control of a mobile manipulator, *International Conference on Signals, Machines and Automation (SIGMA'18)*, NSIT Delhi, India, pp. 1-8, 2018 (**Best paper (session) award winner**)
3. **Santhakumar Mohan**, J. K. Mohanta, B. Corves, M. Hüsing, Dual-loop motion control for geometric errors and joint clearances compensation of a planar 2prp-ppr manipulator, *The 4th Conference on Mechanisms, Transmissions and Applications (MeTrApp 2017)*, Trabzon, Turkey, pp. 1-10, 2017
4. **Santhakumar Mohan**, Burkhard Corves, Philippe Wenger, Design Optimization and Accuracy Analysis of a Planar 2PRP-PRR Parallel Manipulator, *7th IFToMM International Workshop on Computational Kinematics (CK2017)*, Futuroscope-Poitiers, France, pp. 1-8, 2017
5. J. K. Mohanta, **Santhakumar Mohan**, Error Modelling and Sensitivity Analysis of a Planar 3-PRP Parallel Manipulator, *7th IFToMM International Workshop on Computational Kinematics (CK2017)*, Futuroscope-Poitiers, France, pp. 1-8, 2017
6. J. K. Mohanta, **Santhakumar Mohan**, S. Kurtenbach, B. Corves, M. Hüsing, Augmented PID Control of a 2PPR-2PRP Planar Parallel Manipulator for Lower Limb Rehabilitation Applications, *The Joint International Conference of the XII International Conference on Mechanisms and Mechanical Transmissions (MTM) and the XXIII International Conference on Robotics (Robotics'16)* Aachen, Germany, pp. 1-9, 2016

7. Anirban Nag, **Santhakumar Mohan** and Sandipan Bandyopadhyay, Forward Kinematic Analysis of the 3 -RPRS Parallel Manipulator, 6th European Conference on Mechanism Science (Eucomes 2016), Nantes, France, pp. 1-8, 2016 (**Finalist, Best theoretical paper award**)
8. Jayant Kumar Mohanta, **Santhakumar Mohan**, Burkhard Corves, A 2PRP-2PPR Planar Parallel Manipulator for the Purpose of Lower Limb Rehabilitation, 6th European Conference on Mechanism Science (Eucomes 2016), Nantes, France, pp. 1-8, 2016 (**Finalist, Best application paper award**)
9. Yogesh Singh and **Santhakumar Mohan**, Kinematic Performance Analysis of a New 2PRP-PPR Planar Parallel Robotic Manipulator, The Fourth Joint International Conference on Multibody System Dynamics, Monteral, Canada, May-June, 2016
10. V. Vinoth, Yogesh Singh, Jayant Kumar Mohanta, **Santhakumar Mohan**, Robust Disturbance Observer based Sliding Mode Control of a Planar Parallel (3-PPR) Manipulator, Students' Conference on Engineering and Systems (SCES 2014), Allahabad, India, May, 2014. (**Best paper (session) award winner**)

## Research Supervision

### Regular (Full-time) Students at IIT Palakkad (Ongoing)

1. **Arun Krishnan**, Bio-inspired underwater robots (Joined PhD program in December 2019)
2. **Parvathi Sunilkumar**, Assistive and rehabilitation robots (Joined MS program in July 2019)

### Regular (Full-time) PhD Students at IIT Indore

3. **Yogesh Singh**, Performance investigations on mechanical design and motion control of planar parallel manipulators (Joined July 2012, **Thesis defended** in December 2016)
4. **Jayant Kumar Mohanta**, Development and performance investigations of a sitting/lying type lower limb rehabilitation robot (Joined July 2014, **Thesis defended** in July 2018)
5. **Swati Mishra**, Motion control studies and performance investigations of a mobile manipulator (Joined July 2015, **Thesis defended** in May 2020)
6. **Jagadeesh Kadiyam**, Design, development and performance investigations of a hybrid underwater vehicle for ocean observations (Joined January 2017, **Ongoing**)

### Visiting (Other institution) Student

7. **Pandurang Londhe**, SGGs IE & T, Nanded (**Thesis defended** in May 2018)  
**Supervisors:** Prof. Balasaheb Patre and Prof. Laxman Waghmare
8. **Vasanthakumar**, PSG Tech., Coimbatore (Thesis submitted in December 2019)  
**Supervisor:** Prof.B.Vinod
9. **Meera**, UPES Dehradun (Thesis submitted in January 2020)  
**Supervisor:** Dr.Mukul Gupta

### International M.S. Students (Completed)

1. Francesco Alberto Orsini, Politecnico di Torino, Turin, Italy  
Institute: RWTH Aachen University, Germany (2017)
2. Yonghyun Kim, (Co-supervisor: Prof. Jinwhan Kim)  
Institute: Korean Advanced Institute of Science and Technology, Daejeon, ROK (2013)

## Research Collaboration

### International Links

1. Prof. Jinwhan Kim, KAIST, Daejeon, Republic of Korea
2. Prof. Burkhard Corves and Prof. Mathias Huesing, RWTH Aachen, Germany
3. Prof. Philippe Wenger, Ecole Centrale de Nantes (ECN), France
4. Prof. Tae Won Seo, Yeungnam University, Republic of Korea
5. Prof. Jong Won Kim, Seoul National University, Republic of Korea
6. Prof. Yokio Takeda, Tokyo Institute of Technology, Japan

## National Links

1. Prof. L. Behera, IIT Kanpur
2. Prof. G.K. Ananthasuresh, IISc Bangalore
3. Prof. T. Asokan, IIT Madras
4. Prof. S.K. Saha, IIT Delhi
5. Prof. Sandipan Bandyopadhyay, IIT Madras

## **Administrative Service**

### Indian Institute of Technology Palakkad (IITI)

1. Faculty in-charge, International relations (June 2019 – present)

### Indian Institute of Technology Indore (IITI)

2. Associate Dean, Academic Affairs (October 2017 – November 2018)

## **Other Professional Activities**

1. **Associate Editor**, 29th IEEE International Conference on Robot and Human Interactive Communication, Naples Italy, 2020 and 28th IEEE International Conference on Robot and Human Interactive Communication – RO-MAN 2019, New Delhi, India, 2019.
2. **Conference co-chair**, International Conference on Intelligent Robotics, Automation and Manufacturing (IRAM 2013), December 2013, Indore, Madhya Pradesh, India.
3. **Publication co-chair**, Asian Conference on Mechanism and Machine Science, December 2018, Bangalore, Karnataka, India.
4. **Publication chair**, International Conference in Automation, Robotics and Sensing (ICAARS 2016, ICAARS 2018), June 2016 and December 2018, Coimbatore, Tamil Nadu, India
5. **Publication co-chair**, International Conference on Advances in Robotics, June - July 2019, Chennai, Tamil Nadu, India.
6. **Course Coordinator**, Five days GIAN course on "Multibody Dynamics", October 2017, Indore, Madhya Pradesh, India.
7. **Course Coordinator**, Five days GIAN course on "Humanoid Robotics: Modelling and Control", December 2017, Indore, Madhya Pradesh, India.
8. **Course Coordinator**, Five days GIAN course on "Kinematics and Design of Parallel Manipulators", December 2017, Indore, Madhya Pradesh, India.
9. **Course Coordinator**, Five days short term course on "Autonomous Mobile Robots", March 2018, Indore, Madhya Pradesh, India.
10. **Organising Secretary**, Five days short term course on "Mechatronics and Robotics", 2013, Indore, Madhya Pradesh, India.