

CURRICULUM VITAE

Mohanlal Pappu Ponniah, Ph.D

ASI Fellow, AeSI Fellow, IEI Fellow, IETE Fellow, IEEE Senior Member

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Education

Ph.D	2005	University of Kerala, Thiruvananthapuram, India	Computer Science
M.Tech	1995	University of Kerala, Thiruvananthapuram, India	Applied Electronics and Instrumentation
B.E.	1976	University of Madras, India	Electronics and Communication Engineering

Research Experience

2016-Present	Indian Institute of Space Science and Technology (IIST)	Prof. Satish Dhawan Professor	
2014 - Present	ISRO Inertial Systems Unit, ISRO	Director	Inertial sensors, systems, inertial actuators and mechanisms design
2011 - 2014	ISRO Inertial Systems Unit, ISRO	Associate Director	Inertial sensors, systems, inertial actuators and mechanisms design
2009 - 2011	ISRO Inertial Systems Unit, ISRO	Group Director	Launch Vehicle Inertial Systems design
2002 - 2009	ISRO Inertial Systems Unit, ISRO	Head of Division	Navigation Software and Simulation Division
1995 - 2002	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SF	Control and Guidance design for Launch Vehicle
1993 - 1995	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SF	Launch Vehicle Avionics Quality assurance
1988 - 1993	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SE	Electronic Parts Screening & Launch Vehicle System QA
1984- 1988	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SD	Electronic parts Screening
1980- 1984	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SC	Electronic part Screening
1977 - 1980	Vikram Sarabhai Space Centre, ISRO	Scientist/Engineer-SB	Electronic part Screening

Professional Memberships:

- i. Senior Member, IEEE for 20years (**SMIEEE**)
- ii. Fellow, Institution of Engineers, India (**FIEI**).
- iii. Fellow, Astronautical Society of India (**FASI**).
- iv. Fellow, Aeronautical Society of India (**FAeSI**)
- v. Fellow, Institute of Electronics and Telecommunication Engineering(**FIETE**)
- vi. Life Member, Indian Science Congress Association
- vii. Life Member, System Society of India
- viii. Life Member, Indian Society for System Science & Engineering (**ISSSE**).
- ix. Fellow, Indian National Academy of Engineering (**INAE**)

Other Positions

1. Member, Board of Studies, Defence Institute of Advanced Technology (DIAT), Pune.
2. Member, Board of Studies for Computer Science, University of Kerala, Trivandrum

Awards Received

1. ISRO **Team Excellence Award**: “SRE Mission”, 2007
2. ISRO **Team Leader Excellence Award**:“GPS Aided INS for Launch Vehicle”, 2009
3. ISRO **Individual Merit Award**: for Overall contributions to ISRO, 2009
4. ISRO **Team Leader Excellence Award**:“mini RESINS development for Launch Vehicle Navigation” 2010
5. **Astronautical Society of India: Award** for “Rocket and Related Technologies” , 2012.
6. **ISRO** “Performance Excellence Award”, 2014.

Patents

1. Patent Filed and number assigned no: 201641002872 dated 27th Jan 2016.
 - a. "A METHOD FOR IMPROVING GPS POSITIONING AVAILABILITY IN HIGH DYNAMIC PLATFORMS WITH BODY RATES"
Used in ISRO's sounding rockets where the spin is quite high leading to positioning problem which is solved by this new method.
2. "A METHOD OF MANUFACTURING MICRO ELECTRO MECHANICAL VIBRATORY RING RESONATOR" (Filed)
3. "A MONOLITHIC METALLIC FLEXURE PROOF MASS AND INDUCTIVE PICK-OFF BASED SERVO ACCELEROMETER" (Filed)

Major Research and Professional Contributions

As **Director** of IISU and **Chairman ISDRT**, lead the development of ISRO's world class Inertial Sensors, Systems, Inertial Actuators and Precision Mechanisms. The Inertial Navigation Systems developed for ISRO's programs have demonstrated reliable, accurate and consistent performance.

- (1) Designed and developed Inertial Navigation Systems for **PSLV, GSLV, SRE-1, RLV, Chandrayaan-1, MARS Orbiter** Missions, **GPS Aided Inertial Navigation System (GAINS)** for the **first time in ISRO for SRE-1** and Launch Vehicle Navigation. The performance of these navigation systems is excellent, consistent and on par or better than similar class of systems developed by other Nations.
- (2) The Aided Navigation Kalman Filter algorithm and software successfully developed for **SRE-1** Mission is remarkable and was reviewed by National expert committee and **earned special appreciation from the National expert committee**. This development was first of its kind in ISRO and internationally also.
- (3) The GAINS system successfully flown in 22 Launch Vehicle Missions, excellent performance demonstrated and is acclaimed even by foreign customer (ESA-Astrium). Designed and developed **High Dynamic** GPS Receiver and validated for PSLV, GSLV trajectory and dynamics is significant since it is not available for import.
- (4) Developed the **new mini RESINS (REdundant Strap down Inertial Navigation System)** from system conception onwards after solving several technological challenges and successfully flight tested for improved Launch Vehicle reliability, Mission accuracy and enhanced payload.
- (5) Analysis carried out on the three major issues in **ISRO Laser Gyro** and resolved all the technology issues/challenges viz. Output glitch during mode hopping, Position dependant drift variation and light-up failures. **This has lead to the development of Laser Gyros with consistent and accurate performance. Lead the development of advanced Inertial Navigation System based on Ring Laser Gyro and successfully flight tested.**
- (6) **In earlier phase of the career, established the Screening Laboratory** for testing and certifying electronic parts for all Launch Vehicles, developed associated automated test systems and the automated **instrumentation system and balancing algorithm** for the **Schenck** vertical dynamic balancing machine as **import substitute**.
- (7) **Played a major role in delivering many flight systems to the ISRO missions.** Delivered the following flight systems for successful Launch vehicle and Spacecraft Missions.
 - Inertial Navigation systems (RESINS), Rate Gyro Packages (RGP) and GPS Aided INS systems (GAINS) were delivered for **25 PSLV flights and 8 GSLV flights** which include Space Capsule Recovery Experiment, Chandrayan-1 and MARS Orbiter Missions and excellent flight performance obtained.
 - Inertial Reference Units (IRU), Momentum/Reaction Wheels and Solar Array Drive Assembly (SADA) systems were delivered to **25 spacecrafts** and excellent performance achieved. Special Payload Mechanisms were delivered for **4 spacecrafts** (Oceansat-2, Megha Tropiques and INSAT 3D, INSAT 3DR)
- (8) **Potential researcher and visionary** and has initiated research on several advanced R&D and TDP projects in the navigation and related area to meet ISRO's future requirements. Carried out root-cause analysis of many issues has resulted in reliable inertial systems for Launch vehicles and Spacecrafts.

Advanced Research and Development initiatives

Pursuing many R&D activities in inertial sensors, systems and spacecraft mechanisms for future. Few of the major ones are given below.

(a) Atom-Interferometer based Inertial sensors (Gyroscopes, accelerometers and gravity gradiometer) for Autonomous Precision Inertial Navigation System (PINS).

The ultimate revolution in precision inertial navigation is under active focused development world over, particularly in the USA and European Nations based on atom interferometer. Using this technique, achieved accuracy by other Nations for various inertial sensors are

Gyroscope : 10^{-7} deg/hr
Accelerometer : 10^{-4} μ g
Gravity gradiometer : 10^{-11} g/m

Dr.Mohanlal has established laser cooling lab in IISU/ISRO for the first time which is essential for developing sensors based on atom interferometry.

(b) Gravity gradient measurement setup

First time in the country and ISRO, gravity gradient measurement setup has been established. In order to develop atom interferometry based Gyros, accelerometers for building ultra precision INS for future, collaborative efforts initiated with IIST. He has conceived the total R&D effort required for this activity and under his guidance the work is progressing well.

(c) Development of state of the art Video-meter for relative navigation for space rendezvous and docking.

Space rendezvous and docking requires high accuracy relative navigation. In the final phase of docking, i.e. < 300m relative distance between the two bodies namely the target and chaser, the relative attitude, position and velocity accuracy can be achieved by using multiple laser sources on the chaser illuminating the target retro-reflectors on the target and the retro-reflected laser from the designed geometry of reflectors is received at the chaser and observer based estimation technique used to get all the relative navigation parameters.

For this purpose, detailed studies carried out and a video-meter instrument being developed at IISU. Dr.Mohanlal had conceived this development and he is guiding and leading this activity.

(d) Development of Vision Aided INS for safe planetary landing.

In the final phase of any planetary landing, it is essential to avoid hazardous obstacles/regions so that safe landing is possible. This requires progressive imaging of the site as we approach and real time steering based on terrain information and homing for the safest possible landing which requires landing zone optimization. Towards this Dr.Mohanlal has initiated required studies and phase-1 is in progress. This requires image processing, fusion of image data with INS data and algorithms for path and zone optimization. He has identified various phases of development and guiding the team for this activity.

(e) Inertial grade MEMS accelerometer development.

Even though many MEMS accelerometers are available world over, inertial grade MEMS sensor is not matured yet. Silicon Oscillating Accelerometer (SOA) is a new concept in MEMS which can achieve inertial grade accuracy and the literatures are available on this from Draper Lab of MIT, USA. Development of single chip inertial grade (SOA) MEMS accelerometer is in progress under his guidance, configuration finalized and is first of its kind in the country.

Major Design and Developments

- 1. Navigation Systems (Hardware and Software) for PSLV, GSLV, RLV, SRE-2 and LVM3-X Missions:** Navigation System electronics, Navigation Flight & Simulation Software, Navigation System Integration, Navigation checkout systems for system & subsystem.
- 2. Aided Navigation Systems (Hardware and Software) for PSLV, GSLV, RLV, SRE-2 and LVM3-X Missions:** PSLV & GSLV for real time orbit monitoring and RLV, SRE-2 in Closed Loop Guidance mode.
- 3. Navigation and Aided navigation Software for RLV-TD: Air-data estimation (alpha, beta, sigma) using INS data and measured DOL wind, Flush Air Data System and Radar Altimeter and Aided INS data fusion.**
- 4. On-board level alignment (OLA) scheme and software for reducing orbit error due to tilt after alignment for all missions.**
- 5. New generation compact PCI based fully automated checkout systems for testing of RESINS, GAINS, SRE-IMU & sub-systems, Software test bed for Navigation software validation. 15 systems realized and made operational.**
- 6. Mini RESINS with reduced mass and improved performance and reliability for Launch Vehicles:** Uses three mini DTGs, Six Ceramic Servo accelerometers, Single package (25 kg), with DC in and 1553B out, improved redundancy for acceleration channels and high resolution VFC, VIKRAM1601 based Navigation Processor Module. **Qualification/Flight Models realized and successfully flight tested in PSLV C21.**
- 7. Designed and developed Advanced Laser Gyro based INS called Advanced Inertial Navigation System(AINS) with two sensor redundancy for gyros and accelerometers and successfully flight tested in PSLV C23 achieved world class performance of 0.5 nautical mile per hour class.**
- 8. Design and Development of MEMS gyro based rate Gyro package for Launch Vehicle.** Reliable, low mass & power, cheaper and reliable alternative to the existing electro-mechanical rate gyro package. **QM and FM models realized, qualified and successfully Flight tested in PSLV C21.**
- 9. In-house high dynamic GPS receiver (12 channel single RF front end & 24 channel, Dual RF front end) for PSLV, GSLV, RLV and LVM3-X Missions:** Completed algorithm, Hardware and software development. **Engineering Model realized and evaluation successfully completed.**
- 10. Design and development of high accuracy Inertial Referencing and Accelerometer package and the Reaction wheels for Mars Orbiter Mission (MOM) and excellent performance during orbit raising, en-route to Mars, Mars orbital insertion and on-orbit even now.**

Major Analysis, Studies and Major Technical Issues solved

- 1. Solved all the Technology issues/challenges of ISRO Laser Gyros :**
Viz. Output glitch during mode hopping, Position dependant drift variation and light-up failures.

This has led to the development of Laser Gyros with consistent and accurate performance.

2. Root cause analysis of wheel current reduction of DTGs at loop close and effective corrective action implementation. Detailed Analysis of wheel current variation in DTGs; sensor level and system level and acceptance specification generation. **Introduced DTG level milli Watt trace measurement to ascertain bearing integrity after gyro assembly.**
3. Detailed analysis of MeghaTropiques Scan Mechanism (MSM) anomalies onboard and identification of causes for motor current increase with time and spacecraft attitude disturbance.
4. **Root cause analysis carried out successfully for the scan start pixel variation in INSAT 3D imager and sounder payloads.**
5. **Solved the persistent bias jump issue for Servo Accelerometers for Launch Vehicle Navigation.**
6. **Navigation Accuracy improvements: Survey Parameters.** To improve the overall accuracy of navigation, fresh survey (by Survey of India) initiated and completed. **Accurate gravity values at IISU for sensor calibration** and at SHAR for accelerometer channel update, **WGS84 reference latitude & longitude of IISU and SHAR launch pads, Deflection of vertical measurement at IISU & SHAR. All the above measurements completed.**
7. **Satellite Navigation Lab Established:** RF test equipments, Satellite simulator and other accessories acquired and installed to test all elements involved in the development of satellite navigation receiver including GPS, GLONASS, GAGAN Receivers.
8. Navigation system for HSP mission: Overall system configuration, Sensor redundancy configuration, Electronics, Processor, Software, Power-chain configuration.
9. **Significantly contributed for GSLV D3 Failure Analysis** relating INS measurements and control commands: analysis of steering engine ignition, thrust profile, roll rate profile, lateral acceleration analysis with respect to engine anomaly and presentation to FAC. **Contributed significantly for GSLV F06 failure analysis** using lateral accelerometer data and body rates in quantifying transonic buffet loads on the vehicle.
10. Azimuth accuracy requirement being very stringent for MARS Orbiter Mission, verified the accuracy of INS azimuth measurement at launch pad by using an independent instrument Gyromat-3000 with laser attachment by **checking the reference lines in SHAR, IISU, TERLS and direct measurement of azimuth of INS at launch pad.**

Major products developed.

1. Navigation System (RESINS Mark IV) for PSLV and GSLV Missions
2. Navigation System (RESINS Mark IVA) for LVM3X Mission
3. Navigation System (RESINS Mark IVR) for RLV TD Mission
4. Miniaturised Navigation System (mini RESINS) for future Launch vehicle Missions

5. Advanced Inertial Navigation System (AINS) using Laser gyro and Ceramic servo accelerometer for future high accuracy Missions
6. GPS Aided INS for SRE-1 Mission
7. GPS Aided INS for Launch Vehicle Missions (GAINS)
8. High dynamic GPS receiver for Launch Vehicle navigation
9. Servo Accelerometer for Launch Vehicle navigation
10. High accuracy Ceramic Servo accelerometer for Mars Orbiter Mission
11. Miniaturised metallic servo accelerometer for bending mode measurement for LV
12. ISRO Ring Laser gyro
13. MEMS Ring resonator Gyro sensing element
14. Inertial reference and accelerometer package for Mars Mission
15. High resolution Voltage to Frequency converter for Navigation application
16. MEMS rate gyro package for Launch Vehicle control application
17. High resolution and high accuracy multi-bit sigma delta A/D converter
18. Indigenous Instrumentation system for Shenck vertical dynamic balancing machine as import substitute

Research publications and Technical Reports

Published **39 research papers** in Journals, International conferences and National conferences and **590 Technical Reports in my area of work. These technical reports are classified high technology design documents and hence cannot be published.**

Journals

1. Mohanlal P.P, Akbar Ali S, Pillai S.K, Dasgupta S, “**GPS Aided Navigation System for Launch Vehicles**” Proceedings of the 48th AGM of Aeronautical Society of India”, 31st Jan to 1st Feb 1997 at Thiruvananthapuram, pp 319-330.
2. Mohanlal P.P, B.C. Vidwani, A. Abdul Shukkoor, J. Krishnakumar, S. Syamala, “**Navigation System for Closed Loop Guidance of Space Capsule Recovery Experiment (SRE) : Development & Flight Performance**” Proceedings of Satellite Technology day, April 19, ISAC, Bangalore, 2007.
3. **P.P. Mohanlal and Preethi. A**, “Optimal Fuzzy Control of Inverted Pendulum on Cart”, **Parithantha, Vol 15, No.2, Nov 2007, Journal of System Society of India.**
4. Mohanlal P.P, S. Subha Rani and S. Sibi, “**Secondary Injection Thrust Vector Control Power Plant Linearization using Fuzzy Logic for a Launch Vehicle**”, Defence Science Journal (DRDO), Vol.52, No.4, October 2002, pp 409-416.
5. M.R Kaimal, R. Rajesh and Mohanlal P.P, “**An Optimal Rule Generation Scheme using Genetic Algorithm for the Design of a Fuzzy Logic Controller**”, Parithantha, Journal of System Society Science and Engineering, System Society of India, vol.8, no. 1, August 2003, pp 20-25.
6. G.Harikumar, K.Karthikeyan, S.Syamala. C.Radhakrishna Pillai, S.Hemachandran, A.Abdul shukkoor and P.P. Mohanlal, “**Troposphere induced GPS navigation error, its effect on GPS-INS Integrated system performance and mitigation strategies**”, Indian Journal of Radio and Space Physics, pp150-158, June 2013.

International Conferences

7. Mohanlal P.P and Sethunadh. R, "**Virtual Instrument based Dynamic Balancing System for Rockets and Payloads**", IEEE International Conference on Automated test systems, (AUTOTESCON-2007) Sept 17-20, 2007, Baltimore, Maryland, USA, pp 291-296.
8. Mohanlal P.P, A. Abdul Shukkoor, B.C. Vidwani and P.S. Veeraraghavan, "**Hybrid Navigation System for GNC of Space Capsule Recovery Experiment (SRE) : Development and Flight Performance**", 7th International Conference, Navigation and Control Systems (GNC 2008), Ireland, June 2-5, 2008.
9. Mohanlal P.P, A. Abdul Shukkoor, S. Syamala and B.C. Vidwani, "**Scheduled Gain EKF for Data Fusion for re-entry Navigation**", IEEE International Conference on Avionics Systems (ICAS 2008), Hyderabad, Feb 22nd & 23rd, 2008.
10. Mohanlal P.P, M.R Kaimal and Dasgupta S, "**Exact Fuzzy Modeling and Optimal Control of a Launch Vehicle in the Atmospheric Phase**", Proceedings of the seventh International Conference on control, Automation, Robotics and Vision, Dec 2-5, 2002, Singapore, pp 1275-1280.
11. Mohanlal P.P and M.R Kaimal, "**Exact Fuzzy Modeling and Optimal Control of the Inverted Pendulum on Cart**", Proceedings of the 41st International IEEE Conference on Decision and Control, Las Vegas, USA, Dec 10-13, 2002, pp 3255-3260.
12. Mohanlal P.P and M.R Kaimal, "**Exact Fuzzy Modeling and Optimal Control of a Class of Second Order Nonlinear Systems**", Proceedings of the IEEE International Fuzzy System Conference (IEEE-FUZZ2004), Budapest, Hungary, July 2004, pp 611-616.
13. Mohanlal P.P and M.R Kaimal, "**Design of Optimal Fuzzy Observers based on TS Fuzzy Model**", Proceedings of the IEEE International Conference on Fuzzy Systems, IEEE-FUZZ 2004, Budapest, Hungary, July 2004, pp 605-610.
14. **Mohanlal P.P., Jaya G Nair et al**, "Design of a Re-configurable and self- contained Automated checkout system" **presented at IEEE international conference on Measurement & Control in robotics (ISMCR-08) at Bangalore , Sept 2008.**

National Conferences

15. Mohanlal P.P, Harishankar M, Dasgupta S, "**Neural Adaptive Control for Launch Vehicle Auto-Pilot**", Proceedings of the National Workshop on Neuro- Fuzzy Control Systems, Jan 1997, Thiruvananthapuram, pp 55-72.
16. Mohanlal P.P, Uma Syamkumar, Dasgupta S, "**Performance Optimization of Complex Dynamic Systems using Neural Networks**", Proceedings of the National workshop on Neural Networks and Cognitive Systems, CUSAT, Cochin, 23rd to 25th Sept 1998, pp 5-10.

17. Mohanlal P.P, Rekha Sebastian, Dasgupta S, **“Non-linear System Identification using Neural Networks”**, Proceedings of the National Workshop on Neural Networks and Cognitive Systems, CUSAT, Cochin, 23rd to 25th Sept 1998, pp 79-83.
18. Mohanlal P.P and Dasgupta S, **“Harmonic Elimination in PWM Inverters using Neural Networks”**, 21st National System Conference, Jan 23rd to 24th, pp 224-229, 1997.
19. **Malini.G, P.P. Mohanlal, R. Harikumar**, “Error Compensation of Dynamically Tuned Gyroscope Under Vibration Environment”, **proceedings of the 6th National Conference on Technological Trends, 25 to 26th November 2005.**
20. **Mohanlal P.P., et al** “INS checkout system: realization as a real-time system”: **presented at ISRO-DOS workshop on computer & Information Technology (WCIT-08) in Dec 2008.**
21. **Mohanlal P.P. et al**, “Checkout system for Aircraft testing of GAINS: design decisions and lessons learnt”: **presented at ISRO-DOS workshop on computer & Information Technology (WCIT-08) in Dec 2008.**
22. **Mohanlal P.P. et al**, “RESINS Checkout system software: Mapping requirements to Design features”: **presented at ISRO-DOS workshop on computer & Information Technology (WCIT-08) in Dec 2008.**
23. Mohanlal P.P. et al, **“Atom Interferometer Gyro”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011. *Thiruvananthapuram, India.*
24. Mohanlal P.P. et al, **“In-Flight Sensor Calibration And Advanced Fault- Tolerant Scheme For Inertial Navigation For Extended Duration Missions”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011, Thiruvananthapuram, India.
25. Mohanlal P.P. et al, **“Advanced Fusion Techniques For High Accuracy Navigation”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011. *Thiruvananthapuram, India.*
26. Mohanlal P.P. et al, **“GNSS Signal Utilization And Augmentation For A Lunar Mission Navigation”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011. *Thiruvananthapuram, India.*
27. Mohanlal P.P. et al, **“Vision Integrated Inertial Navigation System”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011, *Thiruvananthapuram, India.*
28. Mohanlal P.P. et al, **“Challenges in Navigation System design for Lunar Soft Landing”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011., *Thiruvananthapuram, India.*
29. Mohanlal P.P. et al, **“Challenges And Technologies In Navigation For Rendezvous And Docking”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011, *Thiruvananthapuram, India.*
30. Mohanlal P.P. et al, **“Precision Inertial Navigation System: Challenges for Future”**, Conference on Space Transportation Systems: Opportunities and Challenges, Dec 2011, *Thiruvananthapuram, India.*
31. **“Ground Simulation Techniques for Performance Evaluation of High Dynamics GPS Receiver for Launch Vehicle Applications”**: K S Sandhya, Harikumar Ganesan, K Karthikeyan, S Syamala, S Hemachandran, A Abdul Shukkoor, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.

32. **“Indigenous Fault Tolerant Navigation Processing Electronics for Launch Vehicle Applications”**: Renjis Mathew, Anwar K Backer, Deepa Sara John, KM Surya, B Venkataramana, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
33. **“GPS/INS/RA Data Fusion for Precise Altitude Estimation in Re-entry and Landing Missions”**: K Kesavabrahmaji, KS Sandhya, Arun Zachariah, S Syamala, A Abdul Shukkoor, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
34. **“GPS Aided INS System Performance under Slowly Varying GPS Error Conditions”**: A Flight Simulation Case Study: Harikumar Ganesan, K Karthikeyan, S Syamala, C Radhakrishna Pillai, S Hemachandran, A Abdul Shukkoor, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
35. **“A Novel, Processing Efficient Failure Detection and Isolation Scheme for Triad-Hexad Configuration of Inertial Sensors”**: VS Vinoj, VN Radhika, K Kesavabrahmaji, S Syamala, A Abdul Shukkoor, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
36. **“Extended Kalman Filter based INS/GNSS Integration for Launch Vehicle Navigation”**: Merin Mary Thomas, Kesavabrahmaji Karuturi, S Syamala, A Abdul Shukkoor, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
37. **“Miniaturized Redundant Sensor Electronics for Inertial Navigation System for Launch Vehicles”**: P Rajesh George, CK Deepthy, M Mary Jermila, KP Raghunath, K Anitha, K Jawaharji, G Nithin Dev, N Aparna Vishnu, B Venkataramana, V Devarajulu, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore.
38. **“Sensor based Rate Measurement Package for Control Applications”**: S Sreejith, P Umadevi, J Krishnakumar, **PP Mohanlal**; National Conference on Applications & Challenges in Space Based Navigation during 17-18 April, 2013 at Bangalore
39. **“Thermal Management Of Launch Vehicle Inertial Navigation Package for ISRO’S Mars Mission”**; Rishi Padmanabhan, Ullekh Pandey, T. V. Radhakrishnan, M. J. Chacko, J. Krishnakumar and P. P. Mohan Lal. Proceedings of the 23rd National Heat and Mass Transfer Conference

Training Imparted to ISRO Personnel through Invited lectures.

1. Structured Training Program Lecture on Inertial Navigation for Launch Vehicle at LPSC, ISRO, Valiamala, Trivandrum
2. Structured Training Program Lecture on Inertial Navigation for Launch Vehicle at SDSC, ISRO, SHAR
3. Executive Development Program for ISRO Senior Engineers on Inertial Navigation systems at VSSC, ISRO
4. Structured Training Program Lecture on Inertial Navigation at IISU, ISRO, Vattiyoorkavu, Trivandrum
5. One week long course on GPS Aided Navigation System to B.Tech students of IIST, Trivandrum.
6. IITP Lectures for ISRO fresh Engineers.
7. ISRO level lecture for Engineers from all centres on “Lessons learned – Innovation, a way of life” at ISRO Head Quarters.

Other Invited Lectures Delivered

1. AICTE Lecture on Fuzzy control systems at TKM College of Engineering, Quilon
2. AICTE Lecture on Fuzzy Systems at Sri Chitrathirunal College of Technology, Pappanamcode, Trivandrum

3. Lecture on Kalman Filter and Integrated Navigation at College of Engineering, Trivandrum
4. Lecture on Inertial sensors and Systems at CUSAT , Kochi
5. Lecture on Launch Vehicle Inertial Navigation System at RajivGandhi Institute of Technology, Kottayam
6. Lecture on Global Positioning System at institution of Engineers, Trivandrum
7. Lecture on Atom Interferometer based Inertial sensors and Precision Inertial Navigation System for Aeronautical society of India, Trivandrum.
8. Keynote Address delivered at Govt. College of Engineering at Barton Hill, Trivandrum; for VLSI design and advanced technologies, June 2014.
9. Keynote address delivered on Neural Networks conference at Lourde Matha College of Science and Technology at Trivandrum in July 2015.

Academic Thesis/Projects supervised

Master's degree thesis of Indian Universities supervised.

1. **"Performance Optimization of Complex Dynamic Systems using Neural Networks"**, Uma Syamkumar, MTech Thesis, 1998, Kerala University. **Supervisor: Mohanlal P.P.**
2. **"Non-linear System Identification using Neural Networks"**, Rekha Sebastian, MTech Thesis, 1998, Kerala University. **Supervisor: Mohanlal P.P.**
3. **"Harmonic Elimination in PWM Inverters using Neural Networks"**, Sylvester, MTech Thesis, 1998, Kerala University. **Supervisor: Mohanlal P.P.**
4. **"Secondary Injection Thrust Vector Control Power Plant Linerarization using Fuzzy Logic for a Launch Vehicle"**, S. Sibi, M.E Thesis, Bharathiar university, 2002, **Supervisor: Mohanlal P.P.**
5. **"Error Compensation of Dynamically Tuned Gyroscope under Vibration environment"**, Malini.G, MTech Thesis, 2005, Kerala University. **Supervisor: Mohanlal P.P.**
6. "Optimal Fuzzy Control of Inverted Pendulum on Cart", **Preethi. A**, MTech Thesis, 2007, Kerala University. **Supervisor Mohanlal P.P.**
7. **"Virtual Instrument based Dynamic Balancing System for Rockets and Payloads"**, M.Tech Thesis of Cochin University of science and Technology (CUSAT) , India 2007, **Supervisor: Mohanlal P. P**

B.Tech degree project Supervised of Indian University.

1. "Real time Design of FIR filter using Hope field Neural Network", B.Tech project, Abhilash Miranda, 2000, Kerala University. **Supervisor : Mohanlal P.P.**

Conference activities

1. Technical Committee Chair, ASET (Aeronautical Society of India conference at Trivandrum) 2010 on advances in Navigation Systems for Aerospace.
2. Member, Organising Committee, Space Transportation Syatems conference at Trivandrum organised by INAE and Vikram sarabhai Space Centre, 2012 , Trivandrum
3. Tecnical Sessions committe Chair, Space Transportation Syatems conference at Trivandrum orgalised by INAE and Vikram sarabhai Space Centre, 2012, Trivandrum.

4. AICTE Training lectures(2 nos.) for Engineering colleges(TKM College Quilon, and Sri Chitrathiunal college of Engineering, Trivandrum)
5. . Member, National Advisory committee for ASET 2016 (in April this year) on Advances in Aerospace Inertial Systems, Trivandrum
6. Member, National Advisory Committee for National conference in Advances in Sensors conducted by Sensors Research Society, Jan 2016, Hyderabad.
7. One of the session Chair in the above conference (item:6)

Note: ASET: Abbreviation for Emerging Trends in Aerospace Technologies.