

**Name:**

Dr. Mrs. Vrunda Joshi

**Designation:**

Professor & Head, Electrical Engineering Department,  
Dean (R&D)

**Contact Details:**

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**Educational Qualifications:**

- **Ph.D.** (Systems and Control) in 2008 from **IIT Bombay**  
Topic: Path planning of a spherical mobile robot
- Post-Graduation : M.E. (Electrical-Control Systems) in 1994 (First Class with distinction 76.6.%), Pune University (First Rank at Pune University)
- Graduation: B.E.(Electrical) in 1992 (First Class with distinction 68.8.%), Pune University

**Experience:**

**Total Experience: 27.5 years**

**Academic: 26 years**

**Industry: 1.5 years**

**Academic Experience:**

Professor	Department of Electrical Engineering, PVG's College of Engineering and Technology, Pune	Since 1 <sup>st</sup> September 2010 till date
Assistant Professor	Department of Electrical Engineering, PVG's College of Engineering and Technology, Pune	1 <sup>st</sup> Aug 2005 to 31 <sup>st</sup> August 2010
Senior Lecturer	Department of Electrical Engineering, PVG's College of Engineering and Technology, Pune	July 2001 to July 2005

Lecturer	Department of Electrical Engineering, PVG's College of Engineering and Technology, Pune	July 1995 to June 2001
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### Industrial:

Senior Engineer	Badwe Engineers Pvt. Ltd	June 1994 to 20 <sup>th</sup> July 1995
Junior Engineer	Badwe Engineers Pvt. Ltd	November 1993 to June 1994

### Research Interests:

Mobile Robotics, Nonholonomic Motion Planning, Differential flatness, Quaternions, Rotational kinematics, Nonlinear Control, Brushless D.C. motor and PMSM Drives and Control.

### Research Projects:

Project title	Sponsoring agency	Duration	Amount
Path planning of nonholonomic systems	Department of science and technology	3 years April 2008-March 2011	Rs. 11,80,000
Development of control algorithms for brushless D.C. motor drive	R&DE(Engrs), Dighi, Pune, DRDO LAB	2 years, April 2012-March 2014	Rs. 8,62,700/-
Autodrive with park assist (Cars that drive and park)	Department of science and technology	3 years Apr 2014-March 2017	Rs. 25,31,000/-
Development of state of the art Electrical Vehicle Laboratory	AICTE-MODROB scheme	2 years from December 2020	Rs. 10,89,412/-

## Patents: (Details)

### Patent Registration:

**Title: Permanent Magnet Synchronous Motor Sensor less vector control based on Nonlinear Disturbance Observer**

**Application No. TEMP/E-1/28612/2019-MUM**

**Date of Filing: 2019/07/06**

**Type of patent: Indian**

**Applicant Name: 1. Dr. Vrunda Joshi 2. Aishwarya Apte 3. Hrishikesh Mehta –**

**Pune Vidyarthi Griha's College of Engineering and Technology, Pune -09**

### Field of Consultancy (Aspiring):

Electrical Drives and Control

### Consultancy offered:

CARS project completed with R&DE(E) providing consulting service in the area of 'Sensorless control of BLDC motor'. The project cost is RS. 8,62,700/-

### Number of Publications:

International Journal:11

National Journal:03

International Conference:25

### Number of Books / Book chapters Published: 01

### Number of PhD students Guided: 02

### Number of PG Students Guided: 13

### Recognition/ Awards:

1. The online course developed on 'Implementation of PID control for Self Balancing Robot' received **Rank 1** at **International Level** in all PLEXP courses developed by Dassault Systems.
2. 1<sup>st</sup> rank in 'M.E.' (Electrical ) at Pune University in 1994.
3. The faculty team of PVG's COET, working under my leadership was specially Invited for eYantra Symposium eYS2016 on 11-12 April 2016, for winning best team award for TBT-2015 challenge task

4. The research project “Development of control algorithms for brushless D.C. motor drive” was successfully completed and well appreciated by review committee of R&DE(E), Dighi, Pune, DRDO Lab.
5. The project guided entitled “Design and fabrication of a Spherical Robot” received first prize at SAE (Society of Automotive Engineers), western zone.
6. Recipient of URDIP Women Scientist-C scholarship of DST-TIFAC.
7. Received Best Paper presentation award at ACODS 2016 at NIT, Trichy.

#### **Professional Society Memberships:**

- Member of ISTE

**Number of FDPs / STTPs organized: 05**

**Number of Workshops organized: 04**

**Number of FDPs / STTPs attended: 16**

**Number of Workshops attended: 16**

**Number of Conferences / Seminars attended: 05**

**Number of times served as a Resource Person: 31**

**Number of times served as a Reviewer / Judge: 17**

#### **Details of Research papers published:**

Details of publications available at

<https://scholar.google.co.in/citations?user=F5K81iMAAAAJ&hl=en>

#### **Journal:**

1. Aishwarya Apte, Hrishikesh Mehta, Vrunda Joshi, Rahee Walambe, "Disturbance Observer based Sensorless Control of PMSM using Integral State Feedback Controller" in the IEEE Transactions on Power Electronics. vol. 35, no. 6, pp. 6082-6090, June 2020, doi: 10.1109/TPEL.2019.2949921 **Print ISSN:** 0885-8993 **Electronic ISSN:** 1941-010
2. Rahee Walambe, Narendra Patwardhan, Vrunda Joshi, 'Development of Auto-parking and Collision Avoidance Algorithms on Car type Autonomous Mobile

- Robots', IFAC papers online , Volume 53, Issue 1, 2020, pp. 567-572.  
[doi.org/10.1016/j.ifacol.2020.06.095](https://doi.org/10.1016/j.ifacol.2020.06.095)
3. Ujjwala Thakar, Vrunda Joshi, Vishvesh Vyawahare "Composite Non-linear feedback control using Mittag-Leffler function" International Journal of Dynamics and Control (ISSN 2195-268X) Vol. 7 No. 2, pp. 785-794, Jan 2019 DOI 10.1007/s40435-018-00504-7.
  4. Aishwarya Apte, Ujjwala Thakar, Vrunda Joshi, "Disturbance Observer based Speed Control of PMSM Using Fractional Order PI Controller", IEEE/CAA Journal of Automatica Sinica, Vol. 6, No. 1, pp. 1-11, January 2019
  5. JA Anagal, VA Joshi, R Walambe, "State of Charge Estimation of Lithium Ferro Phosphate Battery Using Extended Kalman Filter", Journal of Control System and its Recent Developments Vol. 1 No. 1, pp. 18-26, 2018
  6. Rahee Walambe, Vrunda Joshi, "Closed Loop Stability of a PMSM-EKF Controller-Observer Structure", IFAC papers online Vol.51, No.1, pp. 249-254, 2018 ISSN. 2405-8963
  7. Apte Aishwarya, Joshi Vrunda, Walambe Rahee, Godbole Ashwini, "Speed Control of PMSM using disturbance observer", IFAC papers online Vol.49, No.1, pp. 308-313, ISSN. 2405-8963, 2016 [doi:10.1016/j.ifacol.2016.03.071](https://doi.org/10.1016/j.ifacol.2016.03.071)
  8. Walambe Rahee, Agarwal Nipun, Kale Swagatu, Joshi Vrunda, "Optimal Trajectory Generation for Car-type Mobile Robot using Spline Interpolation", IFAC papers online Vol.49, No.1, pp. 308-313, ISSN. 2405-8963, 2016, [doi:10.1016/j.ifacol.2016.03.121](https://doi.org/10.1016/j.ifacol.2016.03.121)
  9. Ujjwala Thakar, Vrunda Joshi, Vishvesh Vyawahare, 'Design of fractional-order PI controllers and comparative analysis of these controllers with linearized, nonlinear integer-order and nonlinear fractional-order representations of PMSM' International Journal of Dynamics and Control, Vol. 5, No.1. pp.1-16, 2016. . DOI: 10.1007/s40435-016-0243-0 (ISBN: 2195-268X ISSN:2195-2698)
  10. Sushant Patil, Prof. U.S. Thakar, Dr. V.A. Joshi, Hrishikesh Mehta "SVPWM based Speed Control of PMSM motor with Hall Sensor using DSP TMS 320F2812" in National Journal at The Institution of Engineers (India) Pune Local Centre, Vol. 39, pp. 186-192, ISBN No. 978-81-924990-3-1.
  11. Nipun Agarwal, Rahee Walambe, Vrunda Joshi, Anirudha Rao, "Integration of Grid Based Path Planning with a Differential Flatness Based Motion Planner in a Non-

- holonomic Car-type Mobile Robot”, in National Journal at The Institution of Engineers (India) Pune Local Centre, Vol. 39, pp. 239-245, ISBN No. 978-81-924990-3-1.
12. Rohan C. Tamhankar, Dr. Mrs. V. A. Joshi,” Discrete wavelet transform based Voltage Sag Analysis using DSPIC33F Microcontroller”, in National Journal at The Institution of Engineers (India) Pune Local Centre, Vol. 39, pp. 267-273, ISBN No. 978-81-924990-3-1.
  13. Vrunda A. Joshi, Ravi N. Banavar and Rohit Hippalgaonkar ‘Design and analysis of a spherical mobile robot’, Mechanisms and Machine Theory(MMT), Elsevier Publication. vol.45, no.2, pp.130-136, Feb. 2010.DOI: 10.1016/j.mechmachtheory.2009.04.003
  14. Vrunda A. Joshi and Ravi N. Banavar ‘Motion analysis of a spherical mobile robot’, published in Robotica, Cambridge University Press, vol. 27, pp. 343-353, May2009, doi:10.1017/S0263574708004748.

#### **International conferences:**

1. Aishwarya Apte, Vrunda Joshi, Rahee Walambe, “Generalized ESO for Multiple Input Systems with Mismatched Uncertainty and the solution using Lyapunov Stability Analysis: Application to PMSM” in IFAC Conference on Advances in Control and Optimization of Dynamical Systems ACODS 2018.
2. Walambe R., Nikte S., Joshi V., Ambike A., Pitke N., Ghole M. (2019) Discussion on Problems and Solutions in Hardware Implementation of Algorithms for a Car-type Autonomous Vehicle. In: Kulkarni A., Satapathy S., Kang T., Kashan A. (eds) Proceedings of the 2nd International Conference on Data Engineering and Communication Technology. Advances in Intelligent Systems and Computing, vol 828. pp. 129-136, Springer, Singapore. 978-981-13-1609-8 [https://doi.org/10.1007/978-981-13-1610-4\\_13](https://doi.org/10.1007/978-981-13-1610-4_13) ISSN: 978-981-13-1610-4
3. Aishwarya Apte, Hrishikesh Mehta, Vrunda Joshi, Rahee Walambe, “Sensorless vector control of PMSM using cascaded operation of Sliding Mode Observer and Non-linear Disturbance Observer”, IEEE Symposium on Sensorless Control for Electrical Drives (SLED), 2017.
4. Hrishikesh Mehta, Aishwarya Apte, Swapnil Pawar, Vrunda Joshi, “Vector Control of PMSM using TI F28069 using incremental build level approach” , accepted for

publication at International Conference of Power System ICPS 2017, to be held at College of Engineering, Pune.

## **2016-17**

5. Hrishikesh, Mehta Vrunda Joshi, and Pradeep Kurulkar. "Implementation issues of sliding mode observer for sensorless field oriented control of PMSM using TMS320F2812." In *Sensorless Control for Electrical Drives (SLED), 2016 IEEE Symposium on*, pp. 1-6. IEEE, 2016.
6. Rahee A Walambe, Aishwarya A. Apte, and Vrunda A. Joshi. "Disturbance observer based sensor-less vector control drive for PMSM using EKF." In *Sensorless Control for Electrical Drives (SLED), 2016 IEEE Symposium on*, pp. 1-5. IEEE, 2016.
7. Dhotre Akshay, Deshpande Shraddha, Walambe Rahee, Joshi Vrunda , "Data Acquisition and Hardware Setup Development for Implementation of Feedback Control and Obstacle Detection for Car type Robot", in proceedings of International Conference on Advancements in Automation and Sensing (ICAARS2016), Coimbatore, June 2016. ISBN 9789811028458 (electronic bk.) 9811028451 (electronic bk.) 9789811028441 (print)
8. Ujjwala Thakar, Vrunda Joshi, Vishwesh Vyawahare, "Fractional-order PI controller design for PMSM: A model based comparative study" at 2016 International Conference on Automatic Control and Dynamic Optimization Techniques (ICACDOT) at International Institute of Information Technology (I<sup>2</sup>IT), Pune, 9-10 September 2016.

## **2015-16**

9. Apte Aishwarya, Joshi Vrunda, Walambe Rahee, Godbole Ashwini," Speed Control of PMSM using disturbance observer", presented in the proceedings in 4th IFAC Conference on Advances in Control and Optimization of Dynamical Systems ACODS 2016, Tiruchirappalli, India, 1-5 February 2016, published in the proceedings IFAC papers online Vol.49, No.1, pp. 308-313, ISSN. 2405-8963, [doi:10.1016/j.ifacol.2016.03.071](https://doi.org/10.1016/j.ifacol.2016.03.071)

10. Walambe Rahee, Agarwal Nipun, Kale Swagatu, Joshi Vrunda, "Optimal Trajectory Generation for Car-type Mobile Robot using Spline Interpolation", presented in the proceedings in 4th IFAC Conference on Advances in Control and Optimization of Dynamical Systems ACODS 2016, Tiruchirappalli, India, 1-5 February 2016, published in the proceedings IFAC papers online Vol.49, No.1, pp. 308-313, ISSN. 2405-8963 [doi:10.1016/j.ifacol.2016.03.121](https://doi.org/10.1016/j.ifacol.2016.03.121)
11. Walambe Rahee and Joshi Vrunda, "Survey of EKF based Sensorless Vector Control Methodologies for a PMSM", in the proceedings of 2016 Indian Control Conference, Hyderabad, pp. 93-98, Electronic ISBN: 978-1-4673-7993-9, USB ISBN: 978-1-4673-7992-2, DOI : [10.1109/INDIANCC.2016.7441111](https://doi.org/10.1109/INDIANCC.2016.7441111)
12. U.S.Thakar, Vrunda Joshi, Vishwesh Vyawahare,"Design of Fractional-order PI Speed Controller for Permanent Magnet Synchronous Motor" at International Symposium on Fractional Signals and System, FSS 2015, Romania, pp. 36-42, ISSN: 978-606-737-084-3.
13. Hrishikesh Mehata, Ujjwala Thakar, Vrunda Joshi, Madhav Kuber and Pradeep Kurulkar,"Speed Control of PMSM with Hall Sensors using DSP TMS320F2812" at IEEE PEDS 2015, Sydney, Australia, pp.295-300, ISBN No. 978-1-4799-4402-6/15.
14. Hrishikesh Mehata, Ujjwala Thakar, Vrunda Joshi, Kirti Rathod and Pradeep Kurulkar "Hall Sensor Fault Detection and Fault Tolerant Control of PMSM Drive System" in the International Conference on Industrial Instrumentation and Control (ICIC 2015), Pune, pp.624-628, ISBN No.978-1-4799-7/15.
15. Rahee Walambe, Aishwarya Apte, Vrunda Joshi, Jaywant P. Kolhe, Anjali Deshpande, "Study of Sensorless Control Algorithms for a Permanent Magnet Synchronous Motor Vector Control Drive", in the International Conference on Industrial Instrumentation and Control(ICIC) COEP, Pune, pp. 423-428, ISBN No.978-1-4799-7/15.

## **2014-2015**

16. Aishwarya Apte, Rahee Walambe, Vrunda Joshi, Kirti Rathod and Jaywant Kolhe,"Simulation of a Permanent Magnet Synchronous Motor using Matlab-Simulink", in the International Annual IEEE India Conference (INDICON'14), pp.1-5, ISBN No. 978-1-4799-5364-6/14, DOI: [10.1109/INDICON.2014.7030469](https://doi.org/10.1109/INDICON.2014.7030469).

## **2013-2014**



17. Mrs. K. M. Kurundkar, Dr. V. A. Joshi," Digital harmonic restraint differential relay for power transformer protection", presented at The institute of Engineers- Pune local centre, Technical Journal No: 36, ISBN No: 978-81-924990-0-0

### **Before 2013**

18. "BLDC motor: Different sensorless control techniques", Aishwarya Apte, Dr. V. A. Joshi, published at the National Conference on Advanced Electrical Engineering, in organized by Bharati Vidyapeeth University, Pune, March 2013
19. "Design of vertical axis wind turbine aero-generator" is presented in National conference on "Renewable energy commercialization" during 23rd – 24th April 2012.
20. "Digital protection: The backbone of smart grid" is presented in National conference on "Innovative Smart grid Technologies" during 19- 21 March 2012.
21. "Path planning of a spherical mobile robot using the Liouvillian property", Vrunda A. Joshi, Ravi N. Banavar, in the proceedings of International Conference on Aerospace Engineering (ICEAE09), organized by the department of Aerospace Engineering, IISC, Bangalore.
22. "Path planning of a Spherical Mobile Robot- a partial flatness based approach" in the proceedings of '1<sup>st</sup> International Conference on Mathematical Modeling in Engineering and Biosciences' organized by GAMs.
23. "Design, modeling and controllability of a Spherical Mobile Robot", Vrunda A. Joshi, Ravi N. Banavar, in the proceedings of National Conference of Machines and Mechanisms organized by IISC, Bangalore in December 2007, pp. 135-140
24. "Demand side management controlling maximum demand" by Vrunda. A. Joshi, R. B. Ghatikar at state level seminar organized by SEA association, MSEB, Pune, June 1998.
25. "Microprocessor based maximum demand controller" by Vrunda. A. Joshi, R. B. Ghatikar at national seminar on 'Electrical energy and demand meters' organized by Institute of Engineers, Pune, Jan 1996

### **Details of books / book chapters published:**

#### **Book Chapter:**

“Fractional-order PI controller for Permanent Magnet Synchronous Motor: A design based comparative study” UjjwalaThakar, Vrunda Joshi, Utkal Mehta VishweshVyawahare, Chapter 18(pp. 553-576) in a book ‘Fractional Order Systems Optimization, Control, Circuit Realizations and Applications’ Publisher: Academic Press, Elsevier. Editors: Ahmad Taher Azar and Ahmed G. Radwan

### **Details of FDPs / STTPs attended in last 5 years:**

#### **FDPs/CEPs/Workshops organized:**

- One-week on-line Faculty Development Program on ‘Advances in Electrical Engineering’ from 8<sup>th</sup> June 20-13<sup>th</sup> June 20.
- Three days’ workshop on “MATLAB for Electrical Engineers” on 30<sup>th</sup> Aug -1<sup>st</sup> Sep 2018.

### **Details of FDPs / STTPs attended in last 5 years:**

1. 3 days Faculty Development Program on ‘Outcome based Education’ from 6<sup>th</sup> October-8<sup>th</sup> October 2020

### **Major Portfolios Handled: (college level and department level)**

#### **I. Head, Electrical Engineering Department, PVG’s COET, Pune**

Duration: October 2017- till date

Major Achievements:

- Successful completion of NAAC accreditation in APRIL 2018
- Successful completion of NBA accreditation of Undergraduate Course B.E. (Electrical) for duration of 3 years from AY 2019-20

#### **II. Dean (R&D), PVG’s COET, Pune**

Duration: June 2017- till date

Major Achievements and role:

- MODROB Research grant in AY 2020-21 for ‘Development of Advance Electrical Vehicle Laboratory’
- Training to students and faculty for best research practices and improvement of research quality.

### **Role in University Bodies**

- BOS Chairman, Department of Technology, SPPU

- Member, Faculty of Engineering, SPPU
- Member, Academic Council, SPPU
- VC Nominee, interview committee, SPPU
- Member LIC Committee, SPPU
- Subject Expert, interview committee, SPPU
- Member, Board of Studies, Electrical Engineering, Govt College of Engineering, Pune

## **Industrial Collaborations**

### **I. Activities with R&D (E), Dighi, Pune, DRDO Laboratory**

1. Design Review of project 'Development of Fuel Cell based future Power Supply technologies for Defence Application' at R&DE(E), Dighi DRDO Laboratory on 24th March 2021
2. Panel member for PDR (Peer Design Review) of Project "Advanced Technologies for Electromagnetic Launch system" on 21 Aug 2020.
3. Member, discussion panel for two days workshop on "Legged Robotic/Humanoid Systems in Defence-Futuristic Perspective" on 30<sup>th</sup>- 31<sup>st</sup> August 2019. The objective of the workshop is to carry out focused deliberations on the relevance, role, use, and enabling technologies and their assessment for such robotic systems for defence in the near to far term.
4. An expert review member for Concept Design Review on "Systems and Technologies for Advance Robotics (STAR) project at R&DE(E), DRDO on 27<sup>th</sup> February 2020.
5. Special invitee for review of a project 'Advance technologies for Electromagnetic Launch Systems' at R&DE(E), Dighi, DRDO laboratory on 9<sup>th</sup> April 2019.
6. A committee member for Design Review of "Electromagnetic Aircraft Launcher System (EMALS) on 13.3.2018 at R&DE(E), Dighi, DRDO lab.
7. A member, peer review committee for design and development of 14.5 KW BLDC motor with drive for Mihir missile Launcher, the project being executed at DRDO lab R &DE (Engrs), Dighi.
8. A member, peer review committee for the project on "Design and development of hub motor for Daksh Robot" the project being executed at DRDO laboratory, R&DE(E), Dighi
9. Completed one sponsored research project on 'Development of Control Algorithms for Brushless D.C. Motor' under Contract for Acquisition of Research Services (CARS) scheme in 2014.
10. Expert for various sessions during technical training courses organized for scientists of DRDO laboratories.
11. A judge for Final stage national level 'DRUSE (DRDO Robotics and Unmanned Systems Expositions) competition in 2017.

### **I. Activities with Dassault Systems**

1. Development of online course 'Implementation of PID control for Self Balancing Robot' received **Rank 1** at **International Level** in all PLEXP (Peer Learning Experience Program) courses developed by Dassault Systems in 2017.
2. Development of 'Product Innovation' Laboratory which involves mechatronic setups with 3DExperience based system engineering concepts in 2016.
3. Development of 3DExperience based Virtual Laboratories for Electrical Engineering subjects in 2020.

## **Development of State of the Art Laboratories:**

### **I. Product Innovation Laboratory**

Played instrumental role in the development of 3DExperience based mechatronics laboratory with Dassault Systems in 2016. The laboratory consists of advanced level setups like humonoids, CAR simulators, 6DOF robotic ARM, autowiper system etc. The concept of digital twin is being demonstrated to the students through various setups.

### **II. Embedded Robotics Laboratory**

The laboratory has been setup in collaboration with E-yantra IIT Bombay in 2016. The laboratory consists of mobile robots, sensors and actuators. The laboratory was further developed to cater needs of agricultural industries by appending with '**Agricultural Robotics**' which was sponsored by IEEE and TCS

### **III. TI's Advanced Embedded Control for Drives and Control**

The laboratory consists of advanced digital signal controllers like TMS320F2812/28027 of Texas Instruments along-with 3ph drivers and special machines like Permanent Magnet

### **International/National research collaboration:**

- International Collaboration with Dr. Utkal Mehta of University of South Pacific for Research Activities for joint publications.
- Research Collaboration with Dr. VishveshVyavahare of Ramrao Adik Institute of Technology, Nerul, Navi Mumbai for joint publications.
- Interaction with R&DE(E), Dighi, DRDO lab for technical collaboration for projects like Indegeneous development of BLDC drive, Replacement of PMDC with HUB motors for mobile robot 'Daksh', autonavigation of hybrid vehicles etc. through 'Progressive Design Reviews, Interactive sessions and guest lectures.
- Interaction with I.I.T. faculty for R&D projects, CEP courses and other academic activities.

