Dr. A. Ravi Sankar, PhD (IIT, Kgp)

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School of Electronics Engineering,
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EDUCATIONAL QUALIFICATIONS:

- **Ph. D in Engineering**, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur (IIT, Kgp), Kharagpur, West Bengal, India in the year **2009. (Admission mode : Institute Research Scholar with Teaching Assistance)**
- M.E. (**VLSI Design**- Department of Electronics & Communication Engineering), P.S.G College of Technology, Coimbatore, Tamil Nadu, India in the year 2003. ***CGPA-9.46/10 and batch topper with "Ex" Grades in all the subjects in the 2nd semester.*** **(Admission mode: Through GATE-2001 Examination (All India Rank: 370) Conducted by IIT, Kanpur).**
- B.E. (Electrical and Electronics Engineering) from the University of Madras with 70.46% in the year 1999. **(Admission mode: Through Tamil Nadu Common Engineering Examination).**
- H.S.C. (XIIth) from Don Bosco Hr. Sec. School with 81.5% in the year 1995.
- S.S.C (Xth) from Don Bosco Hr. Sec. School with 90.2% in the year 1993.

REVIEW ASSIGNMENTS FOR SCIENTIFIC JOURNALS:

1) **ACS Sensors** (1 Manuscript – Year : 2019)
2) **IEEE Transactions on Industrial Electronics** *(1 Manuscript - Year : 2015)*
3) **IoP 2D Materials** (1 Manuscript – Year : 2019)
4) **IoP Journal of Micromechanics and Microengineering** (22 Manuscripts – Years 2009, 2010, 2012, 2013, 2014, 2015, 2016, 2017 and 2018)
5) **IoP Nanotechnology** (1 Manuscript - Year : 2013)
6) **IoP Smart Materials and Structures** (2 Manuscripts - Years : 2010 and 2011)
7) **IoP Measurement Science and Technology** (4 Manuscripts - Years : 2011, 2012 and 2016)
8) **IoP Journal of Physics D: Applied Physics** (2 Manuscripts - Years : 2013 and 2016)
9) **IoP Materials Research Express** (1 Manuscript – Year 2017)
10) **IoP Engineering Research Express 2** (1 Manuscript – Year : 2019)
11) **Elsevier Sensors and Actuators A** (5 Manuscripts - Years : 2009, 2011, 2012, 2014 and 2018)
12) **Elsevier Materials Science in Semiconductor Processing** (3 Manuscripts - Years : 2014 and 2019)
13) **Journal of Zhejiang Univ. Sci. (Comp. & Electronics)** *(1 Manuscript - Year : 2012)*
14) **IET Micro and Nano Letters** (9 Manuscripts - Years : 2013, 2014, 2017, 2018 and 2019)
15) **IET Nanobiotechnology (**1 Manuscript - Year : 2019)
16) **IETE Technical Review** (1 Manuscript - Year : 2015)
17) **IETE Journal of Research (**1 Manuscript - Year : 2018)
18) **Springer – Microsystem Technologies** (3 Manuscripts - Years : 2015 and 2019)
19) **SAGE – Advances in Mechanical Engineering** (1 Manuscript - Year : 2015)

FUNDED PROJECT:

Title of the Project: Thermal-Drift Aware Modeling and Design of Surface Stress based Micro/Nano Composite Cantilevers with Integrated Piezoresistors for Biosensing Applications.

Funding Agency: DST, SERB

Duration: 30 months (February 2017 to July 2019)

Sanctioned Amount: INR 22, 12,100/- (Twenty Two Lakh Twelve Thousand One Hundred)

SPECIAL ACHIEVEMENTS:

1) As part of the doctoral research, 4 different acceleration sensors were developed using the in-house educational-institute level fabrication facilities at Indian Institute of Technology (IIT), Kharagpur. Test results of a packaged accelerometer show performance characteristics (in terms of cross-axis sensitivity), better than the commercially available piezoresistive sensors and other devices reported till date.
2) Acceleration sensors developed during my doctoral work, have been pursued for real time applications by Aeronautical Development Agency (ADA), a Defense Research and Development Organization (DRDO) laboratory, Government of India, through National Program on Micro And Smart Systems (NPMASS) program.
3) A special technology for selective electro-deposition of gold film using the combined techniques of electroplating and shadow mask process was developed.
4) Characterized dual doped TMAH etching characteristics including corner undercutting analysis for wet etching based bulk micromachining in the Microelectronics laboratory of IIT, Kharagpur.

SEMICONDUCTOR PROCESSING EXPERIENCE:

As part of the doctoral research work, I have successfully developed 4 MEMS acceleration sensors with hands on experience on different semiconductor processing equipments like,

- *Oxidation and Diffusion Furnaces,*
- *Photo-Lithography – MJB 3 and MA6 (Karl Suss) mask aligners,*
- *Physical Vapor Deposition (Thermal evaporation – Hind HiVac, DC and RF Magnetron Sputtering),*
- *Semiconductor Micromachining(Wet etching – KOH and dual doped TMAH),*
- *Gold electroplating characterization and technology development for selective gold electroplating using shadow mask technique,*
- *Characterization equipments - Ellipsometer, Four-point probe, Surface profiler, Scanning Electron Microscope, etc.*

POSITIONS HELD (PhD and Post-PhD Experience):

1) January 2004 - December 2007 – Institute Research Scholar with Teaching Assistance, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur, India.
2) March 2008 - June 2009 – Project Scientist, Advanced Technology Development Center, Indian Institute of Technology, Kharagpur, India.
3) July 2009 – May 2011– Associate Professor, Department of Electronics and Communication Engineering, School of Electrical Sciences, Karunya University, Coimbatore, India.
4) June 2011 – Till date – Professor, School of Electronics Engineering, Vellore Institute of Technology (VIT), Chennai Campus, India.

PhD Thesis Work:

The doctoral thesis work targeted at the development of a high performance quad beam piezoresistive accelerometer with very low cross-axis sensitivity. Cross-axis sensitivity in piezoresistive accelerometers is an important design issue, particularly for high performance applications. In a beam-mass structure, cross-axis sensitivity is mainly caused by the asymmetrical structural design where the center of mass of the beams is located well above the center of mass of the proof mass. In the present doctoral thesis, selective electrodeposition of the gold film is used to achieve the structural symmetry thereby reducing cross-axis sensitivity. A novel fabrication method for selective electrodeposition of gold layer was developed using the combined process of shadow mask technique and electroplating process. The designed accelerometers were realized by bulk micromachining process using dual doped TMAH as an anisotropic etchant. Test results of a fabricated accelerometer show a very low cross-axis sensitivity of 0.324 µV/Vg at 13 g acceleration and nonlinearity of around 0.5% FS over the acceleration range of 0-13 g.

SUBJECTS TAUGHT:

Indian Institute of Technology, Kharagpur:

1) IC Technology and Process Simulation Lab (EC-69015) – Autumn semester ’04, ’05, ’06 and ’07.
2) Basic Electronics laboratory (EC-14001) – Spring semester ’05, ’06 and ’07.

Karunya University :

Postgraduate subjects:

1) Nanolithography (NT-311) – July ’09 –Oct ’09 & July ’10 – Oct ’10.

Undergraduate subjects:

1) Linear Integrated Circuits and Applications (EC-211) – Nov’09 – Apr ‘10
2) Control Systems (EI-203) – Nov ’09 – Apr ’10 & Nov ’10 – Apr ’11
3) Microprocessor Laboratory (EC-217) – July’09 – Oct ’09.

Vellore Institute of Technology (VIT), Chennai Campus:

Postgraduate subjects:

1) IC Technology (EEE590) - Jan ’13 – Apr ’ 13 & Jan ’14 – Apr ’ 14
2) Digital IC Design - July ’14 – Nov ’14.
3) Analog IC Design (EEE589) – July ’13 – Nov ’13.
4) Physics and Modeling of Semiconductor Devices (EEE587) – July ’12 – Nov ’12.

Undergraduate subjects:

1) Basic Electrical and Electronics Engineering (EEE101) – July ’11 – Nov ‘11
2) Electron Devices and Circuits (ECE101) – Jan ’12 – Apr ’ 12 & Jan ’13 – Apr ’ 13
3) Analog Electronic Circuits (ECE207) - July ’12 – Nov ’12 & Jan ’15 – Apr ’ 15.

COMPUTER SKILLS:

MEMS Design Tools : *CoventorWare 2006 and Intellisuite 8*
VLSI EDA Tools : *XILINX, WARP6.0, VERIWELL, MODELSIM 5.5, V-SYSTEM*
HDLs Known : *VHDL, Verilog HDL.*
Operating Systems : *MSDOS, Windows 95/98/NT, Windows XP, Solaris.*

Conference and Workshops Organized

1. **International Conference on Communication and Signal Processing (ICCOS 2011)**
   Role: Convener

   Details: The Department of Electronics and Communication Engineering, Karunya University organized an International Conference on Communication and Signal Processing on March 17-18, 2011. **More than 900 research articles were submitted to the conference** from various researchers across India and abroad and after the peer review process by the experts, **around 250 papers were selected for discussion and presentation in the conference proceedings.** The conference was inaugurated by Dr. K. M. M. Prabhu, Professor, Department of Electrical Engineering, IIT, Madras. He delivered the plenary talk on Recent Trends in Signal Processing. Mr. Ezhilbudhan, Director, Southern Region, BSNL participated as a chief guest. The Vice Chancellor Dr. Paul P. Appasamy has delivered the presidential address and spoke about the importance of interdisciplinary research. Dr. K. M. M. Prabhu released the Conference Proceedings and handed over the first copy to the Vice Chancellor of Karunya University.

2. **National level workshop on "VLSI, MEMS and Integration"**
   Role: One of the TWO coordinators

   Details: A National level 2-days workshop on VLSI, MEMS and Integration was organized on the 09th –10th days of December 2011. Around 90 participants registered for the workshop. Prof. Navakanta Bhat from IISc Bangalore delivered an invited lecture on the topic, "**Semiconductor Gas Sensor Systems; *Integrating Heterogeneous Technologies".*** The participants had hands-on training for 2 sessions on the VLSI and MEMS CAD tools of CADENCE® and Intellisuite® respectively.

3. **National level workshop on "MEMS Design using CoventorWare®"**
   Role: One of the TWO coordinators and a resource person

   Details: National level 1-day workshop on MEMS design using CoventorWare® was conducted on the 30th of May 2012. Around 60 participants registered for the workshop. Prof. M. Umapathi from NIT, Tiruchirapalli delivered an invited lecture on the topic, "MEMS based Piezoelectric Sensors" Mr. Rakesh Ravindran, Senior Engineer from CoventorWare®, gave hands-on training on various modules of the CoventorWare® software.

4. **Value Added Program on "Op-amp Design using CADENCE®"**
   Role: One of the TWO coordinators and a resource person

   Details: A value added program (VAP) on Op-amp design using CADENCE® was conducted on the 13th and 14th days of April 2014. The VAP was mainly targeted on the under graduate students of Electrical, Electronics and Communication Engineering disciplines. Around 35 students registered for the VAP and trained on various concepts related to op-amp design with hands-on training on various modules on CADENCE® tool.

5. **A Two day workshop on "RF and Inertial MEMS with hands-on Training in Intellisuite® MEMS Software"**
   Role: One of the TWO coordinators and a resource person

   Details: A Two day national level workshop on "RF and Inertial MEMS with hands-on training in Intellisuite® MEMS software" was organized on the 13th and 14th days of March 2015. Around 40 participants registered for the workshop. Hands-on training on various modules of Intellisuite® was provided by the experts from Sridutt Technologies pvt. Ltd. After a brief introduction to the fundamental concepts of MEMS, various devices such as RF switches, phase shifters, pressure sensors and accelerometers were covered with their design using various modules of Intellisuite® (version 8.8) software tool.

RESEARCH PUBLICATIONS:

Selected Refereed Journal Papers:

1) S. Kal, S. Das, D. K. Mourya, K. Biswas, **A. Ravi Sankar** and S. K. Lahiri, "CMOS compatible bulk micromachined silicon piezoresistive accelerometer with low off-axis sensitivity," *Microelectronics Journal, v*ol. 37, pp. 22-30, 2006.

2) **A. Ravi Sankar**, S. Das and S. Kal, "Development of micromachined silicon accelerometers with improved off-axis sensitivity," *Internat. Journal of COMADEM, v*ol. 11, pp.18-24, 2008. ***(Invited Paper)***

3) **A. Ravi Sankar**, S. Das and S. K. Lahiri, "Cross-axis sensitivity reduction of a silicon MEMS piezoresistive accelerometer," *Microsystem Technologies*, vol. 15, pp. 511-518, 2009.

4) **A. Ravi Sankar,** S. K. Lahiri and S. Das, "Performance enhancement of a silicon MEMS piezoresistive single axis accelerometer with electroplated gold on a proof mass," *J. Micromech. Microeng.,* vol. 19**,** 025008 (10pp), 2009.

5) P. K. Dey, B. Pramanick, **A. Ravi Sankar,** P. Ganguly and S. Das, "Microstructuring of SU-8 resist for MEMS and bio-applications," *Int. J. on Smart Sensing and Intelligent Systems*, vol. *3***,** pp. 118-129, 2010.

6) **A. Ravi Sankar**, V. Swathi Sree Bindhu and S. Das, "Coupled effects of gold electroplating and electrochemical discharge machining processes on the performance improvement of a capacitive accelerometer," *Microsystem Technologies,*vol. vol. 17, pp. 1661-1670, 2011.

7) **A. Ravi Sankar**, J. Grace Jency and S. Das, "Design, fabrication and testing of a high performance silicon piezoresistive Z-axis accelerometer with proof mass-edge-aligned-flexures," *Microsystem Technologies*, vol. 18, 15, pp. 9-23, 2012.

8) **A. Ravi Sankar,** J. Grace Jency, J. Ashwini and S. Das, "Realisation of a silicon piezoresistive accelerometer with proof mass-edge-aligned-flexures using wet anisotropic etching," *IET Micro & Nano Letters,* Vol-7, pp-118-121, 2012.

9) **A. Ravi Sankar** and S. Das, "Experimental analysis of galvanic corrosion of a thin metal film in a multilayer stack for MEMS application," *Materials Science in Semiconductor Processing,* Vol-16, pp-449-453, 2013.

10) **A. Ravi Sankar** and S. Das, "A very-low cross-axis sensitivity piezoresistive accelerometer with an electroplated gold layer atop a thickness reduced proof mass," *Sensors and Actuators A,* Vol-189, pp-125-133, 2013.

11) Ribu Mathew and **A. Ravi Sankar**, "Design of a triangular platform piezoresistive affinity microcantilever sensor for biochemical sensing applications," *Journal of Physics D: Applied Physics,* Vol-48, 205402 doi:10.1088/0022-3727/48/20/205402, 2015.

12) Ribu Mathew and **A. Ravi Sankar**, "Numerical study on the influence of buried oxide layer of SOI wafers on the terminal characteristics of a micro/nano cantilever biosensor with an integrated piezoresistor," *Biomedical Physics & Engineering Express,* Vol-2, 055012, 2016. doi:10.1088/2057-1976/2/5/055012

13) Ribu Mathew and **A. Ravi Sankar**, "In Silico modeling and investigation of self-heating effects in composite nano cantilever biosensors with integrated piezoresistors," *AIP Advances* Vol. 7, 035108, 2017, doi: http://dx.doi.org/10.1063/1.4977827.

14) S. Saranya and **A. Ravi Sankar**, "Experimental investigations on the electrical and 2D-machining characteristics of an electrochemical discharge machining (ECDM) process," *Microsystem Technologies*, Vol-23, Issue-5, pp-1453-1461, 2017, DoI: 10.1007/s00542-016-3027-8.

15) K. V. Meena, Ribu Mathew and **A. Ravi Sankar**, "Design and optimization of a three terminal piezoresistive pressure sensor for catheter based *in-vivo* biomedical applications," *Biomedical Physics and Engineering Express*, Vol. 3, 045003, 2017. DoI: https://doi.org/10.1088/2057-1976/aa768d.

16) S. Vetrivel, Ribu Mathew and **A. Ravi Sankar**, "Design and optimization of a doubly clamped piezoresistive acceleration sensor with an integrated silicon nanowire piezoresistor," *Microsystem Technologies*, Vol-23, Issue-8, pp-3525-3536, 2017. doi:10.1007/s00542-016-3219-2.

17) K. V. Meena, Ribu Mathew, Jyothi Leelavathi and **A. Ravi Sankar**, "Performance comparison of a single element piezoresistor with a half-active Wheatstone bridge for miniaturized pressure sensors," *Measurement*, Vol-111, pp-340-350, 2017, DoI: https://doi.org/10.1016/j.measurement.2017.07.052

18) Ribu Mathew and **A. Ravi Sankar**, "Impact of isolation and immobilization layers on the electro-mechanical response of piezoresistive nano cantilever sensors," *Journal of Nanoscience and Nanotechnology*," Vol. 18, pp- 1636-1647, 2018, DoI: https://doi.org/10.1166/jnn.2018.14209

19) Ribu Mathew and **A. Ravi Sankar**, "A review on surface stress based miniaturized piezoresistive SU-8 polymeric cantilever sensors," *Nano-Micro Letters*, Vol. 10, 1-41, 2018, DoI: https://doi.org/10.1007/s40820-018-0189-1.

20) Ribu Mathew and **A. Ravi Sankar**, "Piezoresistive composite silicon dioxide nanocantilever surface stress sensor: design and optimization," *Journal of Nanoscience and Nanotechnology*," Vol. 18, pp- 3387-3397, 2018, DoI: https://doi.org/10.1166/jnn.2018.14642
21) Ribu Mathew and **A. Ravi Sankar**, "Optimization of a nano-cantilever Biosensor for reduced self-heating effects and improved performance metrics," *Journal of Micromechanics and Microengineering*, Vol. 28, 085012, 2018, DoI: https://doi.org/10.1088/1361-6439/aabeaf
22) S. M. Sakthivel **and A. Ravi Sankar**, "An ASIC based invisible watermarking of grayscale images using pixel value search algorithm (PVSA)", *Multimedia Tools and Applications* – Vol. 77, pp- 26793–26819, 2018, DOI: https://doi.org/10.1007/s11042-018-5889-5.
23) S. Saranya and **A. Ravi Sankar**, "Fabrication of precise microchannels using a side-insulated tool in a spark assisted chemical engraving process," *Materials and Manufacturing Processes*, Vol. 33, pp- 1422-1428, 2018, DoI: 10.1080/10426914.2017.1401728.
24) S. Saranya and **A. Ravi Sankar**, "Fabrication of precise micro-holes on quartz substrates with improved aspect ratio using the constant velocity feed drilling technique of an ECDM process," *Journal of Micromechanics and Microengineering* – Vol. 28, 125009, 2018, DoI: https://doi.org/10.1088/1361-6439/aae8f5.
25) Ribu Mathew and **A. Ravi Sankar**, "Influence of surface layer properties on the thermo-electro-mechanical characteristics of a MEMS/NEMS piezoresistive cantilever surface stress sensor," *Materials Research Express*, 2019, https://doi.org/10.1088/2053-1591/ab1c18
26) S. Vetrivel, B. Anupama Menon, Ribu Mathew and **A. Ravi Sankar**, ""Influence of the flexure position and a thick gold film on the performance characteristics of doubly fixed quad beam proof mass structures," *IETE Journal of Research* – 2019, https://doi.org/10.1080/03772063.2019.1620643

Selected Refereed Conference Papers:

National Conference Papers:

1) **A. Ravi Sankar**, S. Kal, "Finite Element Method Based Design and Simulation of Silicon MEMS PZR Acceleration Sensors for Aircraft Motion Sensing", *Conference in Advances in Space Science and Technology (CASST 2007)**, IIT Kharagpur***., India, 14-16 Jan, 2008.
2) **A. Ravi Sankar**, I. S. Bajpayee, S. Das, S. Kal, "Fabrication and Testing of Silicon MEMS PZR Acceleration Sensors for Aircraft Motion Sensing", *Conference in Advances in Space Science and Technology (CASST 2007)**, IIT Kharagpur***., India, 14-16 Jan, 2008.
3) S. Saranya, **A. Ravi Sankar**, "Experimental Analysis of the Critical Voltage of an Electrochemical Discharge Machining Process", 1st National Conference on Micro and Nano Fabrication, CMTI, Bangalore, 21-23, January, 2013, pp. 93-98.

International Conference Papers (Conferences held in India):

1) **A. Ravi Sankar**, V. Saini, S. Das, S. Kal, "Temperature Drift Analysis in Silicon Micromachined Piezoresistive Accelerometer," ***IEEE Indicon***, IIT Kharagpur, India, 20-22, Dec 2004. **doi:** 10.1109/INDICO.2004.1497822
2) **A. Ravi Sankar**, S. Das, S. Kal, "Silicon MEMS Piezoresistive Accelerometers with Reduced Off-axis Sensitivity: I. Simulation and Analysis," *Proc. of the 5th International Conference on Trends in Industrial Measurements and Automation*, NIT Tiruchirappalli, India, 4-6 Jan 2007, pp. 72-77.
3) **A. Ravi Sankar**, S. Das, S. Kal, "Silicon MEMS piezoresistive accelerometers with reduced off-axis sensitivity: II. fabrication and testing," *Proc. of the 5th International Conference on Trends in Industrial Measurements and Automation (TIMA -07)* , NIT Tiruchirappalli, India, 4-6 Jan 2007, pp. 78-82.
4) **A. Ravi Sankar,** S. Das and S. K. Lahiri, "Fabrication and Testing of Single Axis Silicon MEMS PZR Accelerometer with Enhanced Performance using Electroplated Gold on Proof mass," *International Conference on MEMS (ICMEMS-2009)*, IIT Madras, Chennai, India, 3-5 Jan 2009.
5) **A. Ravi Sankar** and S. Das, "Experimental Analysis of Galvanic Corrosion of Al-Cr-Au Metals Stack for MEMS Application," *International Conference on MEMS (ICMEMS-2009)*, IIT Madras, Chennai, India, 3-5 Jan 2009.
6) **A. Ravi Sankar**, B.Anupama Menon, K. Anu Keechery, "MEMS Piezoresistive Cantilever type Accelerometer Structures with Electroplated Gold", 2nd International Conference on Sensors and Related Networks (SENNET-09), VIT University, Vellore, India, 8-10 December, 2009, pp. 135-139.

7) **A. Ravi Sankar**, K. Anu Keechery, B. Anupama Menon, "Space Efficient Convex Corner Compensation Structures in Anisotropic TMAH etching", 2nd International Conference on Sensors and Related Networks (SENNET-09), VIT University, Vellore, India, 8-10 December, 2009, pp. 140-143.
8) J. Anju Anna, S. Saranya, A. Ravi Sankar, "Effects of Tool Dimension and Electrolytic Concentration on Spark Generation of the Electrochemical Discharge Machining Process", 3rd International Conference on Sensors and Related Networks (SENNET-12), VIT University, Vellore, India, 19-21 January, 2012, pp. 64-66.
9) Sakthivel, S.M., A. Ravi Sankar, "A Real Time Watermarking of Gray Scale Images without Altering its Content," IEEE International Conference on VLSI Systems, Architecture, Technology and Applications (VLSI-SATA 2015), Amirtha University, Bangalore, India, 8-10, January 2015, pp. 1-6.
10) Sakthivel, S.M., A. Ravi Sankar, "A VLSI Architecture for Watermarking of Gray scale Images using Weighted Median Prediction," 2nd IEEE International Conference on Electronics & Communication Systems, Karpagam College of Engineering, Coimbatore, India, 26-27, February 2015.
11) Sakthivel, S.M., A. Ravi Sankar, " FPGA Implementation of Data Hiding in Gray scale Images using Neighbour Mean Interpolation," 2nd IEEE International Conference on Electronics & Communication Systems, Karpagam College of Engineering, Coimbatore, India, 26-27, February 2015.
12) S. Saranya, and A. Ravi Sankar, "Effect of tool shape and tool feed rate on the machined profile of a quartz substrate using an electrochemical discharge machining process", 2nd International Symposium on Physics and Technology of Sensors (ISPTS-2), CMET, Pune, India, 8-10, March 2015, pp. 313-316. DOI: 10.1109/ISPTS.2015.7220137
13) S. Vetrivel and A. Ravi Sankar, "Finite element method based design and simulation of a doubly clamped accelerometer with integrated silicon nanowires," International conference on nanomaterials and nanotechnology (NANO-15), 7-10 December 2015, Tiruchengode, Tamil Nadu, India.
14) A. Ravi Sankar, S. Das, "Fabrication of an Out-of-plane Deflecting Accelerometer Structure using a Single Step Double Side Wet Etching Process," 3rd *International Conference on Emerging Electronics (ICEE),* IIT Bombay, Mumbai, India, 27-30, December, 2016.
15) Ribu Mathew, A. Ravi Sankar, "Impact of the Isolation and Immobilization Layers on the Electro-mechanical Response of Piezoresistive Micro/nano Cantilever Sensors," 3rd *International Conference on Emerging Electronics (ICEE),* IIT Bombay, Mumbai, India, 27-30, December, 2016.
16) S. Vetrivel, Ribu Mathew, A. Ravi Sankar, "Design and Simulation of a Doubly Clamped Accelerometer with Integrated Silicon Nanowires," 3rd *International Conference on Emerging Electronics (ICEE),* IIT Bombay, Mumbai, India, 27-30, December, 2016.
17) Ribu Mathew, A. Ravi Sankar, "Temperature Induced Inaccuracy in Composite Piezoresistive Micro/Nano Cantilever Chemical/Biological Sensors," IEEE Sensors 2018, New Delhi, India, 28-31, October, 2018.
18) K. V. Meena, Ribu Mathew, A. Ravi Sankar, "A Finite Element Method Based Approach of Modeling of a Piezoresistive Accelerometer by Incorporating Doping Profile of a Diffused Resistor," IEEE Sensors 2018, New Delhi, India, 28-31, October, 2018.
19) Ribu Mathew, A. Ravi Sankar, "Impact of additive gold immobilization layer on the performance of piezoresistive micro/nano-cantilever chemical/biological sensors," International Workshop on Nano/Micro 2D-3D Fabrication, Manufacturing of Electronic – Biomedical Devices & Applications (IWNEBD-2018), IIT Mandi, Himachal Pradesh, India, 31st October – 2nd November 2018.
20) K. V. Meena, Ribu Mathew, A. Ravi Sankar, "A Finite Element Method (FEM) based Approach of Modeling a Miniaturized Silicon Piezoresistive Pressure Sensor by Incorporating Doping Profile of a Diffused Resistor," International Workshop on Nano/Micro 2D-3D Fabrication, Manufacturing of Electronic – Biomedical Devices & Applications (IWNEBD-2018), IIT Mandi, Himachal Pradesh, India, 31st October – 2nd November 2018.
21) S. Saranya, A. Ravi Sankar, "Micromachining of quartz substrates using an electrochemical discharge machining (ECDM) process," International Workshop on Nano/Micro 2D-3D Fabrication, Manufacturing of Electronic – Biomedical Devices & Applications (IWNEBD-2018), IIT Mandi, Himachal Pradesh, India, 31st October – 2nd November 2018.

International Conference Papers (Conferences held abroad):

1) **A. Ravi Sankar**, S. Kal, "Structural Sensitivity Analysis of Slanted Beam MEMS Capacitive Accelerometers," **IEEE *Tencon***, Taipei, Taiwan, *Oct 30 – Nov 2, 2007*.

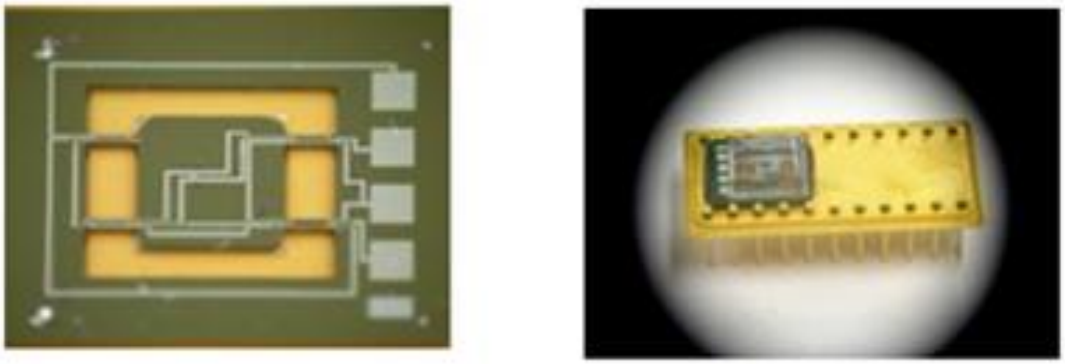
Research Guidance:

S.No	NAME	REG. No.	DEGREE	CURRENT STATUS
1	S.SARANYA	11PHD1031	PHD	2019 (Degree Awarded)
2	K.V.MEENA	11PHD1021	PHD	2019 Degree Awarded)
3	RIBU MATHEW	12PHD1032	PHD	2018 (Degree Awarded)
4	S. M. SAKTHIVEL	12PHD1057	PHD	2019 (Thesis Submitted)
5	SATYA SWAROOP	16PHD1102	PHD	On-going- Expected to complete by the year 2021
6	R. SRINIVASAN	19PHD1071	PHD	On-going- Expected to complete by the year 2023
7	S. VETRIVEL	13MSR1009	MS	2017 (Degree Awarded)

PERSONAL PROFILE:

- Name : A. Ravi Sankar
- Father's name : A. Arunagiri Nathan
- Sex : Male
- Marital Status : Married
- Language Known : Tamil, English and Telugu
- Nationality : Indian

Some Photographs of the accelerometers developed during the doctoral research work are provided hereunder:

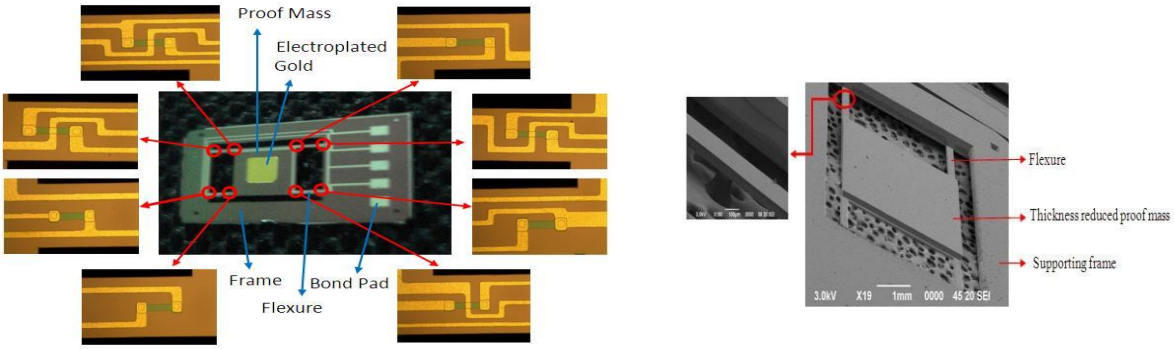


(a) (b)

Fig. 1 (a) Front view of a fabricated quad-beam accelerometer and (b) the sensor in a 22 pin metal can package

(a) (b)

Fig. 2 **Accelerometer with an electroplated gold layer**, (a) processed wafer with Cr/Au seed layer and electrical interconnection lines for subsequent electroplating and (b) micromachined accelerometer chips with different areas of plated gold and microphotograph showing close view of gold, aluminum and piezoresistors



(a) (b)

Fig. 3 Accelerometer with thickness reduced proof mass, (a) Microscopic photograph of the front view of a fabricated device with a closer view of the diffused piezoresistors and (b) an SEM photograph of backside view of an accelerometer **device with the thickness reduced proof mass** and a closer view of a flexure