

Pankaj Sagar, PhD

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I did my doctoral degree (Ph.D) in Cryogenic Instrumentation from Department of Instrumentation and Applied Physics, Indian Institute of Science (IISc), Bangalore, India. My broad areas of research includes design and development of cryogenic sensors, Vacuum systems, cryostat, cryo-compatible systems and advanced data acquisition.

Major research work handled

- Nov 2017– Feb 2020 **SERB – DST India, Multilayer Planar Inductor Based Sensors for RRR and Thickness measurement.**
 - Design, development and testing of a planar inductor based RRR measuring technique for SRF cavities utilizing PCB based sensing elements and cold electronics based signal conditioning circuits capable of operating down to 4.2 K. An eddy current based sensing technique was developed and Nb samples of known RRR values was used to determine the accuracy of the method.
- Aug 2013– Feb 2020 **STC – ISRO, Calibration of 700 mm and 400 mm capacitive type level sensor for LOX and LH₂.**
 - Developing the data acquisition system used to for acquiring the capacitance data utilizing a single capacitance bridge. A relay based switching system was also developed and appropriate control logic using LabView was developed
- Aug 2016– Mar 2017 **STC – ISRO, Design, development and calibration of HTS based level sensor for LOX and LH₂.**
 - Design, development and testing of high temperature superconductor based level sensor utilizing 3G superconducting tapes for use as level sensor for launch vehicle application.
- Aug 2013– Feb 2020 **STC – ISRO, Calibration of PT-500 temperature sensors upto 4.2 K.**
 - Developing and maintaining the data acquisition system used for the calibration procedure.

Education

Academic Qualifications

- Feb-2019– Feb-2020 **Post-Doctoral Fellow in Cryogenic Instrumentation** , Centre for Cryogenic Technology, IISc Bengaluru, Karnataka, India.
- Aug-2013– Jan-2019 **Ph.D in Cryogenic Instrumentation** , Department of Instrumentation and Applied Physics, IISc Bengaluru, Karnataka, India.
- 2010–2012 **M. Tech in Applied Electronics and Instrumentation**, College of Engineering, Kerala University, Kerala, India, CGPA: 8.07.

- 2006–2010 **B. Tech in Applied Electronics and Instrumentation**, *Rajagiri School of Engineering and Technology, M. G. University, Kerala, India, Percentage: 71.2.*

Notable Research Contributions

- **Ph.D Thesis:** *'Cryogenic Instrumentation using Planar Inductor based Eddy Current Sensors'*
Cryogenic sensors have become vital in the measurement of crucial parameters in the modern scientific research. My thesis dissertation addresses the design, development and testing of PCB based planar inductors and associated cold electronics for different types of sensors working at cryogenic temperatures. Three different applications (at 4.2K) were selected and current sensor technologies limitations were overcome utilizing eddy current based sensing elements and clever use of cold electronics integrated into the sensor. The first application involves Residual Resistivity Ratio (RRR) measurement technique utilizing planar PCB based multilayer inductor coils. This work is vital for SRF cavity fabrication and performance evaluation. Second utilizes planar inductor based proximity sensor for 4.2 K applications. This work was inspired by developing sensors for measuring close proximity displacements at a very high accuracy in space environments. The third sensor is an angular displacement sensor operating down to 4.2 K. This work was inspired by work done for Ariane launch vehicles for a non-contact through wall rotation sensor.
- **M. Tech thesis** *'Space Vector based Pulse Width Modulation Scheme for Multilevel Inverters Using the Concept of Multi-Valued Logic'*
A novel approach that unifies the two distinct fields of Multivalued logic and Multilevel inverters. It offers a new interpretation for Multi-level inverters. A multi-level inverter driven by a space vector pulse width modulation scheme based on the Multi-valued logic was implemented on an open end wound 3 phase motor and its current and voltage waveforms were studied.
- **B.Tech main project** *'Slew Rate Meter'*
An innovative instrument used to measure the slew rate of any Op-Amp available in the market. Designed an entirely new circuit called digital window comparator which would produce precise timed voltage windows, utilizing cheap off the shelf digital IC's.

Technical and Personal skills

- **Programming Languages:** Proficient in: C, C++, LabView, Python, Matlab, Micro C, TeX.
- **Industry Software Skills:** Ansoft Maxwell, Matlab Simulink, Ansys Structural and Thermal, LTSpice (SPICE), VxWorks, Orcad, Microwind.
- **General Business Skills:** Good presentation skills, Works well in a team.

Experience

- **Research Associate** – Centre for Cryogenic Technology, IISc Bangalore (February 2019 - Present)
- **Assistant Professor** – Rajagiri School of Engineering and Technology, Kerala (June 2012- May 2013)
- **Guest Lecturer** – College of Engineering, Trivandrum, Kerala (2011 – 2012)

References

- Prof R. Karunaniti :- Professor (Ph.D Supervisor), CCT, IISc, <karun@iisc.ac.in>
- Prof M. R. Baiju :- Professor, Member, Kerala PSC, <mrbaiju@gmail.com>
- Prof Madhava Panicker :- Professor, RSET, <pappadi.madhavapanicker@gmail.com>
- Mr. D. S. Nadig :- Principal Research Scientist, CCT, IISc, <durgeshnadig@gmail.com>
- Prof Subash Jacob :- Professor, CCT, IISc, <jacani4956@gmail.com>

Patent filed

- [1] Pankaj Sagar, Abhay Singh Gour, and Karunanithi R. Multilayer planar inductor based proximity sensor and associated electronics operating down to liquid helium temperature, December 2016. IN Patent R20,164,035,984.

Journal Publications

- [1] Pankaj Sagar, Harris K Hassan, E. D. A. Lakshmi, Kashif Akber, Girish P. S., Abhay Singh Gour, R Karunanithi. Investigation on Temperature Dependent Inductance (TDI) of a Planar Multi-Layer Inductor (MLI) down to 4.2 K. *Review Of Scientific Instruments*, 91(9):726–738, 2020.
- [2] Pankaj Sagar and Karunanithi R. A non-contact rrr estimation using planar inductor sensing element. *Measurement*, 146:758–769, 2019.
- [3] Pankaj Sagar, Abhay Singh Gour, and Karunanithi R. A multilayer planar inductor based proximity sensor operating at 4.2 k. *Sensors & Actuators: A. Physical*, 2017.
- [4] Pankaj Sagar, Harris K Hassan, Abhay Singh Gour, and R Karunanithi. Multilayer planar inductor array based angular position sensor for cryogenic application. *Cryogenics*, 96:18–24, 2018.
- [5] P. Sagar, H.K. Hassan, and R. Karunanithi. A technique for measuring impedance of cryogenic eddy current sensors using dual switched oscillators. *Journal of Instrumentation*, 13(08):T08006, 2018.
- [6] Abhay Singh Gour, Pankaj Sagar, and R Karunanithi. Investigation of cryogenic level sensors for In₂ and Iox. *Cryogenics*, 84:76–80, 2017.
- [7] Abhay Singh Gour, Pankaj Sagar, and R Karunanithi. Design, development and testing twin pulse tube cryocooler. *Cryogenics*, 86:87–96, 2017.
- [8] Pankaj Sagar, Vignesh Krishna, Abhay S Gour, M Gowthaman, H Sudharshan, S Srinivasan, R Karunanithi, and S Jacob. Design and development of experimental setup to measure the rrr values of a thin film coated superconducting sample. *Indian Journal of Cryogenics*, 42(1):152–155, 2017.
- [9] Pankaj Sagar, Abhay Singh Gour, and R Karunanithi. Capacitance level sensor with integrated cold electronics. *Indian Journal of Cryogenics*, 43(1):160–163, 2018.
- [10] Abhay S Gour, Pankaj Sagar, H Sudharshan, R Karunanithi, and S Jacob. Hts based 400 mm level sensor for liquid nitrogen. *Indian Journal of Cryogenics*, 43(1):143–147, 2018.

Conference Publications

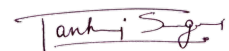
- [1] Nagendra, HN and Verma, R and Sagar, P and Akber, K and Kasthuriengan, S and Shivaprakash, NC and Sahu, AK and Behera, U. Design optimization and calibration of a void fraction measurement capacitance sensor for LN₂ flow. In *IOP Conf. Series: Materials Science and Engineering*, volume 755. 012079, 2020.
- [2] P Sagar, R Karunanithi, H K Hassan, K Akber, P S Girish, S Chandran Lakshmi, and E D A. An eddy-current based rrr measurement technique for srf cavities. In *IOP Conf. Series: Materials Science and Engineering*, volume 502. 012154, 2019.

- [3] Pankaj Sagar, R. Karunanithi, and Abhay Singh Gour. Effect of temperature variation on cold electronics based Ic oscillator for rrr measurement. In *14th Cryogenics 2017*. IIR International Conference, 2017.
- [4] Abhay Singh Gour, Sagar Pankaj, Joy Joewin, Mallappa A., Sudharshan H, R. Karunanithi, and S. Jacob. Experimental studies on twin ptc's driven by dual piston head linear compressor. In *ICEC26-ICMC2016*. IOP Conference Series, 2016.
- [5] R Karunanithi, S Jacob, DS Nadig, MVN Prasad, Abhay S Gour, S Pankaj, M Gowthaman, and H Sudharshan. Calibration of a hts based lox 400 mm level sensor. *Physics Procedia*, 67:1169–1174, 2015.
- [6] Karunanithi R, Jacob S, D. S. Nadig, M.V.N. Prasad, Abhay S. Gour, Pankaj S, Gowthaman M, and Sudharshan H. Calibration of an hts based lox 400mm level sensor. In *25th International Cryogenic Engineering Conference and the International Cryogenic Materials Conference in 2014, ICEC 25-ICMC 2014*, volume 67, pages 1169–1174. Elsevier B.V., 2014.
- [7] Pankaj Sagar, Shiny G, and M. R. Baiju. Space vector based pulse width modulation scheme for multilevel inverters using the concept of multi-valued logic. In *10th International Conference on Power Electronics & Drive Systems (PEDS-2013)*, pages 1360–1365. IEEE, 2013.
- [8] Pankaj Sagar and Madhava Panicker P. R. A novel, high speed window comparator circuit. In *IEEE International Conference on Circuits Power and Computing Technology (ICCPCT-2013)*, pages 691–693. IEEE, 2013.
- [9] Pankaj Sagar, Likhin M, Abdul Nazer K H, Naveen N, and Asha Joseph. Implementation of cmnn based industrial controller using vxworks rtos ported to mpc8260. In *2013 Third International Conference on Advances in Computing and Communications*, pages 239–242. IEEE, 2013.
- [10] Pankaj Sagar, Shiny G, and M R Baiju. Implementation of space vector pwm for multilevel inverters using the concept of multi-valued logic. In *National Conference on Technological Trends (NCTT-2012)*, pages 246–252. CET, 2012.

Declaration

It is therefore asserted that this document is an interpretation of my edificial and supplemental application and the information specified here is true to the best of my knowledge

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