# IAP Seminar Series

## Sensing Techniques and Systems for Automotive and Industrial Applications - Design and Development

**Date:** 13th Aug 2025 **Time:** 3PM **Venue:** ONLINE

**Abstract:** The talk will focus on some of the sensors and sensing techniques developed for automotive and other industrial applications. During the initial phase, some of the important sensing challenges faced in the design of the IPT system for the charging of EVs are addressed. Electric vehicles (EVs) are an excellent alternative to gasoline-powered vehicles when it comes to sustainability and the reduction of environmental pollution. Inductive power transfer (IPT) based charging has been gaining popularity over plug-in EVs as it helps to have reduced battery capacity as well as improved convenience and safety while charging. In the design of the IPT highway, one of the challenges faced is the detection of EV, to enable charging, as it travels along the highway. A sensor system was developed to detect the EV approaching the primary (ground) pad laid on the highway, so as to enable charging when it detects sufficient coupling between the primary and secondary (vehicle) pads. Another challenge faced in commercial IPT systems is that the primary pad should be able to interoperate with different types of secondary pads. For this, an MR sensor-based sensing technique was developed to identify the type of secondary pad so that the primary is energized in the correct mode.

Afterwards, a wireless readout circuit designed for simultaneous and independent measurement of inductance and resistance in series-RLC configuration is presented. The proposed readout technique involves measuring the reflected impedance from the primary side, and the sensor resistance and/or inductance is calculated using the real and imaginary components of the reflected impedance. The key advantage of this method is that the measurement is independent of the coupling coefficient (k) between the primary and the secondary, over a considerable range of k, except in the cases of very weak coupling (low values of k).

Following this, a brief description of an easy-to-fabricate, full circle range (0o-360o), planar coil-based variable reluctance (VR) angle transducer with enhanced linearity is presented. By carefully designing the coil geometry to achieve uniform flux distribution and implementing a simple semicircular-shaped rotor, the sensor system offers enhanced performance and linearity.
The sensing techniques designed to address these challenges were optimized for the number of sensors and the sensor positions, using numerical analysis and finite element analysis. This was followed by detailed experimental studies to validate the functionality of the sensor systems.

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## About the Speaker

Dr. Jeshma Thalapil Vaheeda received the B.Tech. degree in electrical and electronics engineering from the National Institute of Technology (NIT), Calicut, India, in 2011, and the M.Tech. and Ph.D. degrees in electrical engineering from the Indian Institute of Technology (IIT) Madras, Chennai, India, in 2013 and 2022, respectively. Since 2023, she has been a Lecturer in Electric Vehicles at the School of Engineering, Computing and Mathematics, Oxford Brookes University, Oxford, UK. She has previously worked at Robert Bosch Engineering and Business Solutions Limited, Bangalore, India and General Electric Research, Bangalore, India. Her research interests include sensors and signal conditioning, and measurements and instrumentation for automotive and industrial applications.