

# **Design and Optimisation of Next Generation Compact Photonic Sensors**

*A Seminar of the IEEE WA joint EDS/SSCS/IPS Chapter*

**Prof. B M A Rahman**

Professor of Photonics

Department of Electrical and Electronic Engineering  
School of Mathematics, Computer Science and Engineering  
City, University of London

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**Venue: Billings Room 3.04, 3<sup>rd</sup> floor. Electrical & Electronic Engineering Building  
University of Western Australia, Crawley**

*This seminar is open to the public and admission is free to all IEEE members and non-members*

## ***Abstract:***

Although optical sensors incorporating grating inscribed and etched fibres are now sufficiently mature and well established in the market, however, designs based on more exotic nanowires and photonic crystal fibres are becoming increasingly important and showing much improved sensitivity by accessing a larger evanescent field. Similarly, novel planar design concepts, such as the silicon slot guide-based design is showing even greater promise, allowing the exploitation of well-developed CMOS fabrication technologies for potentially low-cost sensor elements. In compact Integrated Optic format, dielectric slots, plasmonic slots, Mach-Zehnder interferometer, and ring resonators are also emerging as novel photonic sensors.

However, high index contrast also makes the modes in such sensing structures fully hybrid in nature and in such a case, full-vectorial rigorous numerical approaches will be necessary for their design optimisation. Some selected results for silicon based compact photonic sensors will be presented illustrating the value and potential of the computationally efficient finite element method in such designs. The development of slot waveguides has created new opportunities for exotic optical sensor by guiding light in low index sensing area, such as air or water in the slot region and thus creating the potential for more advanced, sensitive yet very compact and low-cost photonic sensors. The design and optimisation of such novel vertical slots, horizontal slots and polarization independent cross-slots or biosensing will be presented. The design of a novel plasmonic slot supporting complex plasmonic modes for gas sensing will also be presented. The design optimisation of metal-coated silica nanowire for bio sensing and doped ZnO coated gold nanowire for gas sensing, chemical sensing and a resonating straight slots for biosensing will also be presented.

## ***Biography:***

B. M. Azizur Rahman received the B.Sc.Eng and M.Sc.Eng. degrees in Electrical Engineering with distinctions from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh, in 1976 and 1979, respectively. He also received two gold medals for being the best undergraduate and graduate students of the university in 1976 and 1979, respectively. In 1979, he was awarded with a Commonwealth Scholarship to study for a PhD degree in the UK and subsequently in 1982 received his PhD degree in Electronics from University College London.



In 1988, he joined City, University of London, as a lecturer, and became a full professor in 2000. At City, he leads the research group on Photonics Modelling, specialised in the use of rigorous and full-vectorial numerical approaches to design, analyse and optimise a wide range of photonic devices. He has published more than 550 journal and conference papers, and his journal papers have been cited more than 5500 times, with an h-index value of 34. He has supervised 31 students to complete their PhD degrees as their first supervisor and received more than £11 M in research grants. Prof. Rahman is a Life Fellow of the IEEE, and Fellow of the Optical Society of America and the SPIE.