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Biography

Guangya Zhou received the B.Eng. and Ph.D. degrees in optical engineering from Zhejiang University, Hangzhou, China, in 1992 and 1997, respectively. He joined the Department of Mechanical Engineering, National University of Singapore in 2001 as a research fellow and in 2005 as an assistant professor. And from 2012, he is an associate professor in the same department. His research covers optical MEMS scanners, tunable optics, MEMS spectrometers and hyperspectral imagers, optical MEMS based ultra-compact endoscope probes, silicon nanophotonics, NEMS tunable photonic crystals, and nano scale optomechanics.

Presentation Title: NEMS coupled photonic cavities for sensing

Coupled photonic cavities that give rise to symmetric and anti-symmetric resonant modes are well known in photonics. The resonant frequencies/wavelengths of such modes vary as functions of coupling strength. Integrated with nanoelectromechanical systems (NEMS) actuators, we have demonstrated various tunable photonic resonators, for example those tuned through varying their coupling gaps as well as through laterally shifting their center-to-center offsets. We demonstrated experimentally that large resonance wavelength shifts up to a few tens of nanometers could be achieved with small movements of the NEMS actuators. Alternatively, such coupled photonic cavities can also be configured as sensors, since nanoscale displacements can induce large resonance frequency shifts. As an example, we demonstrate here a resonant magnetic field sensor based on coupled nanophotonic cavities with one cavity fixed to the substrate and the other movable suspended by NEMS springs. An external magnetic field generates a Lorenz force, which deflects the movable cavity in this coupled-cavity system thereby changing the cavity coupling strength. Subsequently, this induces changes in the resonant frequencies of both symmetric and anti-symmetric supermodes. Through the detection of this frequency variation, the external magnetic field strength can be detected. Due to the small mode volume, high Q factor, and high optomechanical coupling coefficient, this mechanism may potentially lead to new highly sensitive, ultra-small sensors with wider bandwidths and thus faster response compared with existing MEMS magnetometers.