Instructor:
Arti Agrawal; *University of Technology Sydney*

Short Course Description:
Numerical modelling and simulation of optical devices and components is a key tool in improving performance by reducing time and monetary costs, design optimization and characterization as well as innovating new ideas. Both passive and active devices are modelled and optimized numerically. In some cases simulation is the only way to explore phenomena where technology is not advanced enough for fabrication. The interaction of the optical beam with physical effects such as non-linearity, stress, strain, change in refractive index due to temperature, application of electric fields etc. are now extremely important. Modelling complements experimental work perfectly and almost no research is conducted without it.

The Finite Element (FE) method is one of the most popular and powerful methods for modelling in Photonics. This short course starts with Maxwell's equations and explains the basic principles of numerical modelling and the key assumptions involved. This foundation is used to develop the FE method, including a brief tour of the mathematics. How the method can be applied to various optical devices is discussed as an overview

Some salient features of the short course include:

- Emphasis on practical application of FEM for modelling of devices
- Discussion on developing code
- Perfectly Matched Layer and Periodic boundary condition
- Importance of mesh for structures, post-processing of results
- Discussion on popular commercial software such as COMSOL and how to best utilize them

Methods covered include:

- Full vector Finite Element method for modal solution
- Introduction to inclusion of physical effects with the optical model