OPTICAL MICRO-PILLAR HEXAGONAL RESONATOR
FOR PHOTONIC INTEGRATED CIRCUITS

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Optical communication has been attracting great interest because of its large bandwidth and low loss. However, bandwidth is limited by the physical properties of fiber.

Dense Wavelength Division Multiplexing (DWDM) is introduced to resolve the limitation of bandwidth. 32 channels with slightly different wavelength are input coupled into a single fiber.

Separation of channels is the most critical issue for the development of DWDM.

Optical resonator is a wavelength sensitive device to separate different channels in a DWDM system.

Optical resonators have been gaining great interest by its small size and high performance.

Conventional circular design has the disadvantages of short interaction length and fabrication difficulties.

Polygonal shaped resonators is introduced since it doesn’t have the disadvantages of circular designs.

In this project, hexagonal micro-cavity is investigated. Finite Difference Time Domain (FDTD) numerical method is employed to simulate the characteristic of hexagonal micro-resonators. Discrete and waveguide coupled hexagonal micro-cavities are simulated.
Simulation spectrum of the discrete shown in the inset. The size of the hexagon is 2μm. The launch angle is centered at 60°.

The measured intensity is larger than 1, because we are measuring inside the cavity. Multiple interference contributes this intensity enhancement inside the cavity.

Continuous wave (CW) simulation of the wavelength ≈ 1.1μm.

9 pairs of maxima can be observed around the rim. 3 pairs are at the center.

Tangential field emission is shown in the figure. Clockwise azimuthal field distribution is demonstrated.
Hexagonal microcavity add/drop filter simulation is carried out with this filter schematic.

The size of the hexagon is 20μm, the waveguide width is 0.3μm and the air gap is 0.3μm.

Simulation spectrum of the hexagonal microcavity add/drop filter.

The intensity shown is less that 1 while in discrete cavity is larger than 1, because we are measuring the intensity at the waveguide. The max intensity is 1.

CW simulation of the hexagonal microcavity add/drop filter. Steady state after ≈10 loops is shown. It is clear that resonance is built up after 10 loops.