

Channarong Kusalajeerung 2012: Analytical Study of Optical Bistability in Silicon Ring Resonator. Master of Science (Physics), Major Field: Physics, Department of Physics.
Thesis Advisor: Assistant Professor Surasak Chiangga, Dr.rer.nat. 71 pages.

Silicon microring resonators have become one of the important optical devices in ultrafast, compact, all-optical processing circuits. Microring resonators have been implemented as tunable filters, dispersion compensators, sensor and lasers.

This thesis studies theoretically the optical bistability of continuous wave propagating within silicon-on-insulator waveguide. The evolution of the electric field in silicon-on-insulator waveguide can be described by Maxwell's equation, which includes dispersion, linear absorption, two-photon absorption, free-carrier absorption, free-carrier dispersion and thermo-optic effect.

We find that optical bistability in silicon-on-insulator ring resonator is independent of two-photon absorption. The hysteresis width increases (decreases) with decreasing (increasing) input wavelength (free-carrier lifetime). The thermo-optic effect induces multiple bistability. We demonstrate theoretically the optical switching by changing the free-carrier lifetime with constant input intensity.

Student's signature

Thesis Advisor's signature

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