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Thermal models for silicon-on-insulator-based optical circuits

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Keywords

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Abstract

Silicon has many advantages as a material for planar photonics but it does not possess a linear electro-optic effect. Whilst free carrier injection has been used to produce optical switches based on silicon on insulator (SOI) rib waveguides, the thermo-optic effect provides an attractive alternative way of modulating the refractive index in these structures. In this paper a fast analytical thermal solver is developed for SOI-based thermo-optic switches. It is shown that lateral heat leakage limits the temperature rise that can be achieved for a given thermal input power. The analytical model is then extended to allow investigation of the effect of thermal isolation trenches. These are found to improve performance by a factor of three. Finally, the effect of these trenches on the modes supported by the waveguide is briefly discussed.