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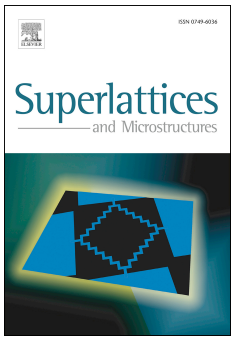

Optical-analog-to-digital conversion based on successive-like approximations in octagonal-shape photonic crystal ring resonators

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Optical-analog-to-digital conversion based on successive-like approximations in octagonal-shape photonic crystal ring resonators

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Abstract:

Implementing intensity-dependent Kerr-like nonlinearity in octagonal-shape photonic crystal ring resonators (OSPCRRs), a new class of optical analog-to-digital converters (ADCs) with low power consumption is presented. Due to its size dependent refractive index, Silicon (Si) nanocrystal is used as nonlinear medium in the proposed ADC. Coding system of optical ADC is based on successive-like approximations which requires only one quantization level to represent each single bit, despite of conventional ADCs that require at least two distinct levels for each bit. Each is representing bit of optical ADC is formed by vertically alignment of double rings of OSPCRRs (DR-OSPCRR) and cascading *m* number of DR-OSPCRR, forms an *m* bit ADC. Investigating different parameters of DR-OSPCRR such as refractive indices of rings, lattice refractive index, and coupling coefficients of waveguide-to-ring and ring-to-ring, the ADC's threshold power is tuned. Increasing the number of bits of ADC, increases the overall power consumption of ADC. One can arrange to have any number of bits for this ADC, as long as the power levels are treated carefully. Finite difference time domain (FDTD) in-house codes were used to evaluate the ADC's effectiveness.

Keywords: Optical analog-to-digital conversion (OADC); Kerr-like nonlinearity; octagonal-shape photonic crystal ring resonator (OSPCRR).

1. Introduction:

Since 1974, photonic based analog-to-digital convertors (ADCs) have been used for improvement of ADC functions. Optical technologies have fundamentally influenced the electronic ADCs and proved useful at overcoming their bottleneck for accessing higher speeds