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Quantization of electromagnetic field in an inhomogeneous medium based on scattering matrix formalism (S-quantization)

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We have developed a procedure for quantization of the electromagnetic field in a layered inhomogeneous media based on analysis of the Eigen values of the scattering matrix (S-matrix). In contrast to the method involving quantization of the electromagnetic field, involving the use of periodic boundary conditions (Born-von Karman conditions), the proposed procedure (S-quantization) is based on equality of the amplitudes of waves incident on a quantization box and waves outgoing from the quantization box, which is equivalent to equating unity Eigen values of the scattering matrix. We perform a comparison of the density of states and spatial structure of the field calculated with periodic boundary conditions and using the procedure of S-quantization. S-quantization allows calculating modification of the spontaneous emission rate for arbitrary inhomogeneous structure and direction of the emitted radiation. S-quantization solves the long-standing problem coupled to normalization of the quasi-stationary electromagnetic modes. Examples of application of S-quantization for the calculation of spontaneous emission rate for the cases of Bragg reflectors, micro-cavities, photonic quasi-crystals and plasmonic structures are demonstrated.

Biography

Mikhail Kaliteevski has completed his PhD from Ioffe Institute, St-Petersburg, (Russia). He is principal research scientist and head of research team focusing on nanophotonics in Academic University, Ioffe Institute and ITMO University. He has published more than 150 papers in reputed journals and serving as an Editorial Board Member of repute.

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