LARGE DEVIATION APPROACH FOR STUDY OF ERRORS IN FIBER COMMUNICATION SYSTEMS

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Evaluation of error statistics in optical fiber systems is both an important practical and a challenging theoretical problem. Acceptable error levels in modern systems are extremely low, which makes straightforward Monte Carlo type simulations impractical and experimental measurements very expensive since systems must be built. The main source of such errors are optical fiber disorder and temporal noise due to the optical amplifiers. We have studied signal propagation in fibers in the presence of noise and disorder and demonstrated that the error level in such a system fluctuates. Using the instantonic approach we computed the most harmful noise and disorder configurations and evaluated the probability distribution function for error fluctuations. We have shown that this probability distribution has long extended tails. The decay is algebraic or log-normal and thus events far from the mean, such as data transmission outrages, are much more likely that in a standard normal or exponential distribution. These result have been verified in the laboratory.

NONLINEAR PHENOMENA IN OPTICAL METAMATERIALS

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Recent progress in nanofabrications has stimulated intensive research in the field of dielectric-metal nanocomposite materials. These materials exhibit counterintuitive optical properties. One of the most unusual of these properties is negative refractive index. We will discuss new features which such materials bring to nonlinear optics, present equations describing the interaction of these materials with optical fields and analyze solutions of these equations.

UNIQUENESS INVERSE BOUNDARY SPECTRAL PROBLEM FOR RIEMANNIAN POLYHEDRA

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We consider an admissible Riemannian polyhedron with a piece-wise smooth boundary. The associated Neumann Laplacian defines the boundary spectral data as the set of eigenvalues and restrictions to the boundary of the corresponding eigenfunctions. We prove that the boundary spectral data prescribed on an open subset of the polyhedron boundary determine uniquely the admissible Riemannian polyhedron.

DIFFRACTION OF SURFACE WAVES ON A VERTICAL INTERFACE

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A problem of diffraction of waves on a vertical interface of media is studied. The waves are radiated by a point source. The reflected and refracted wave fields are obtained by the method of parabolic equation. The corresponding transformation coefficients are found for the Neumann boundary condition. This paper was supported by the Russian Foundation for Basic Research (RFFI) (grant 05-01-00936).

NEW EXACT SOLUTIONS FOR ACOUSTIC SURFACE WAVES PROPAGATION IN A LAYERED STRUCTURE

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New exact solutions describing acoustic surface waves in an arbitrary layered structure are found by a separation of variables. An attention is given to solutions with plane wavefronts but a polynomial dependence on lateral variables, to their inhomogeneous-plane-wave analogous and to beam-like solutions, which are highly localized in a given sector at large lateral distances.

SINGULARITIES OF THE POINT SOURCE FIELD IN PERIODIC STRUCTURES

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The Green's function in an isotropic inhomogeneous medium satisfies the following equation

$$\left[\Delta + k_0^2\, n^2(z)\right] G(z, z_1, \mathbf{r}_\perp) = -\delta(\mathbf{r} - \mathbf{r_1}),$$

and the condition of radiation. Here k_0 is the wave number, $\mathbf{r}_\perp$ is the component the $\mathbf{r}$ vector normal to the z axis, and $\delta(\mathbf{r})$ is a three dimensional δ-function. The refractive index $n(z)$ is a periodic function, $n(z + T) = n(z)$.

We are seeking the solution in the form of Fourier integral

$$G(z, z_1; \mathbf{r}_\perp) = \int G(z, z_1; \mathbf{q}) \exp(-i\mathbf{q}\mathbf{r}_\perp) d^2\mathbf{q}.$$

We are interested in the far-field asymptotics. The main result is that there exist singular directions for which the usual stationary phase method is inapplicable. For these directions, the corresponding contributions to the Green's function are not proportional to R^{-1}, but to $R^{-5/6}$.