DAYS ON DIFFRACTION 2012

INTERNATIONAL CONFERENCE

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ABSTRACTS

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FOREWORD

"Days on Diffraction" is an annual conference taking place in St. Petersburg since 1968. The event is organized in May–June by St. Petersburg State University, St. Petersburg Department of Steklov Mathematical Institute and Euler International Mathematical Institute of the Russian Academy of Sciences.

This booklet contains the abstracts of 211 talks to be presented at oral and poster sessions in 5 days of the Conference. Author index can be found on the last page.

The full texts of selected talks will be published in the Proceedings of the Conference. The texts in LaTeX format are due by June 20, 2012 to e-mail `diffraction12@gmail.com`. Format file and instructions can be found on the Seminar Web site at `http://www.imi.ras.ru/~dd/proceedings.php`. The final judgement on accepting the paper for the Proceedings will be made by the Organizing Committee following the recommendations of the referees.

We are as always pleased to see in St. Petersburg active researchers in the field of Diffraction Theory from all over the world.

Organizing Committee

- A nonstationary Maxwell system

$$\partial_t(\varepsilon E) = \operatorname{rot} H, \quad \partial_t(\mu H) = -\operatorname{rot} E$$

can have a solution

$$E(t,x) = ie^{-it}u(x), \quad H(t,x) = e^{-it}u(x), \quad \mu(x) = \varepsilon(x),$$

having a fixed compact space support.

- The Maxwell operator in the whole space with periodic coefficients ε, μ can have an eigenvalue of infinite multiplicity. In case of scalar $\varepsilon, \mu \in C^2$ the spectrum of periodic Maxwell operator is absolutely continuous (see [3]).

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Beams dynamics and Lagrangian manifolds

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Under beams we understand here solutions of 3-D wave equation and its dispersive generalizations and Schrödinger type (paraxial optics) approximation localized in the neighborhood of the z-axis. There exist a huge physical and mathematical literature devoted to different problems connected with beams and their propagation. There are well known Gaussian beams, Bessel beams, Airy–Bessel beams etc. Our observation is that one can describe asymptotic solutions corresponding to various beams and their propagation using geometrical objects known as Lagrangian manifold in the phase space and the Maslov canonical operator.

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Seismic wave velocity and attenuation anisotropy analysis for media with one system of parallel fractures

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Oriented fracture systems cause seismic wave velocities and attenuation anisotropy. One system of parallel fractures in isotropic media is described by an effective model of transversally isotropic

(TI) medium with a symmetry axis normal to fracture planes. This model is based on linear slip (LS) boundary conditions for a medium consisting of identical thin layers [1–3]. LSTI model is valid for wave propagation if a wavelength λ much greater than a layer's thickness. Generalization of LSTI model on media with attenuation ($LSTI \to LS\widetilde{T}\widetilde{I}$) was performed and validated by T. Chichinina, for example [4, 5]. Fractures in the model with attenuation $LS\widetilde{T}\widetilde{I}$ are described by matrix of elasticity-attenuation with complex-valued elements including Lamé constants of the isotropic background and the complex-valued normal and tangential weaknesses [5].

Numerical modeling was performed to find optimal variants of estimating complex-valued weaknesses responsible for velocity-attenuation anisotropy in an attenuative linear-slip transversely isotropic (LSTI) model of a fractured medium. Velocities and attenuations of the three wave types (qP, qSV, SH) versus an angle between the symmetry axis and the wave normal were computed for media with different values of the ratio V_S/V_P in the isotropic background and varying values of the real and imaginary parts of the normal and tangential weaknesses. These data were analyzed and then inverted for complex-valued weaknesses. Inversion was made for various combinations of data (velocities, attenuations), wave types and angle intervals (0°–45°, 45°–90°). The results concerning the optimal ways for estimation the complex-valued weaknesses occurred to be as follows. At first, the values of the real parts neglecting the unknown imaginary parts of the weaknesses are to be determined from the velocity anisotropy, namely, for the normal weakness using qP-wave and for the tangential one using SH-wave. Then with the values of the real parts known, one determines the values of the imaginary parts. For the normal weakness, the qP-wave attenuation anisotropy is used, and for the tangential one SH-wave anisotropy. The velocity and attenuation anisotropy of qSV-wave is recommended to use only in the case of weak anisotropy to avoid cusps at the qSV-wave ray velocity surface. Joint inversion of qP- and SH-wave data can also yield good results.

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Early stage dynamics of the regulation network with microRNA

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We consider a mathematical model of a complex network of genes expression, regulating by the microRNA (miRNA), which is the non-coding short RNA molecule containing 10–20 nucleotides only. One of the regulatory mechanisms of gene expression extensively studied in the last years involves miRNA, see [1, 2]. These small regulatory molecules bind a recognition sequence of the target protein-coding matrix RNAs (mRNAs) and preclude them from translation. Recent studies showed that miRNAs participate in buffering of genetic noise in the regulatory systems and in the reduction of the phenotypic variability. It is realized now that this function of miRNA can be explained only