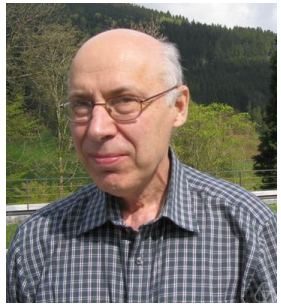
Quasilinear equations and inverse problems



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Leader of the project in Russia:

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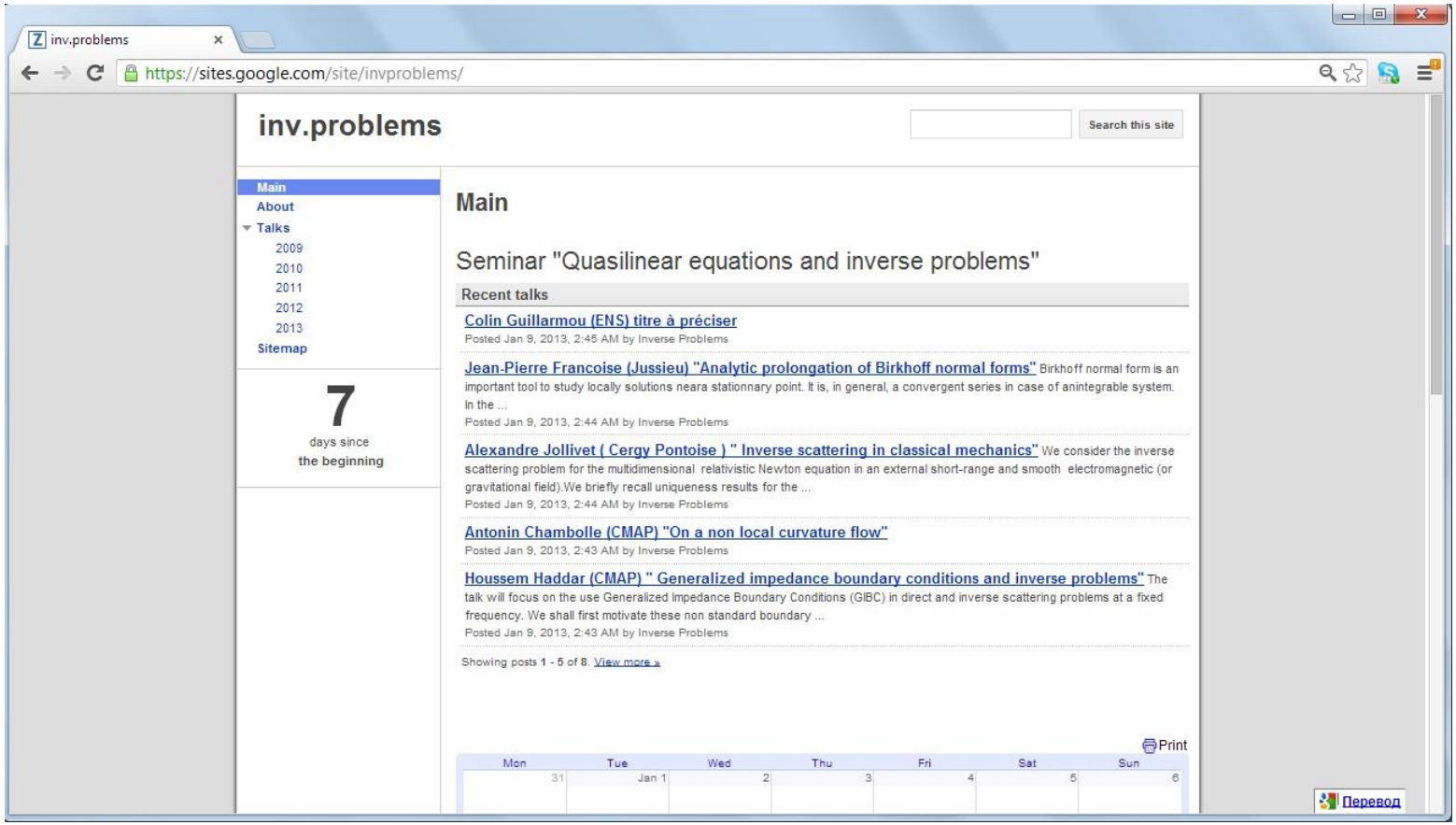
International seminar “Quasilinear equations and inverse problems”

https://sites.google.com/site/invproblems/



Talks of 2013

- Alexandre Tsybakov (Crest & CMAP, Ecole Polytechnique) "Statistical estimation in inverse problems"
- Alexandre Shananin (MSU, MIPT) "Inverse problems in mathematical economics. Nonparametric method for analyses of products substitution"
- François Golse (CMLS, Ecole Polytechnique) " Nonlinear Regularizing Effects for Hyperbolic Conservation Laws "
- Houssem Haddar (CMAP, Ecole Polytechnique) " Generalized impedance boundary conditions and inverse problems"
- Antonin Chambolle (CMAP, Ecole Polytechnique) "On a non local curvature flow"
- Alexandre Jollivet (Université de Cergy Pontoise) " Inverse scattering in classical mechanics"
- Jean-Pierre Francoise (Université P.-M. Curie) "Analytic prolongation of Birkhoff normal forms"
- Colin Guillarmou (Ecole Normale Superieure), to be precised

Generalizations of the Korteweg-de Vries equation

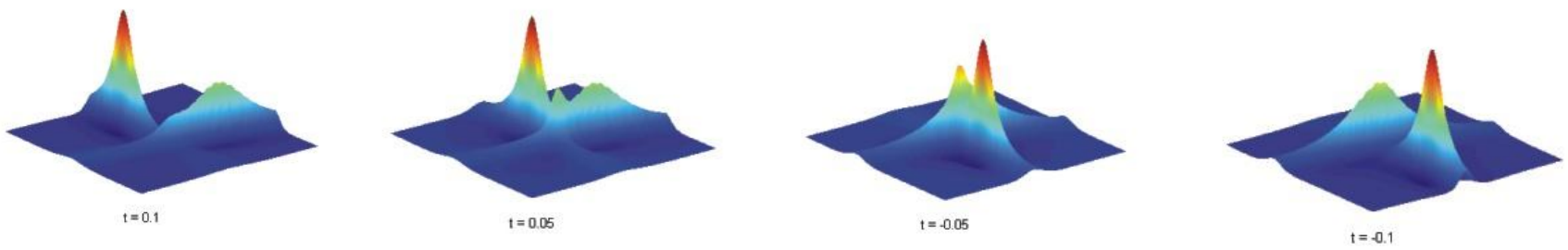
- Viscous generalization: Korteweg-de Vries-Burgers equation

$$u_t + (f(u))_x + au_{xxx} - bu_{xx} = 0$$

- (2+1)-dimensional generalization: Novikov-Veselov equation

$$u_t = 4\,\mathrm{Re}(4\partial_z u + 2\partial_z(vw) - E\partial_z w),$$
$$\partial_{\bar{z}} w = -3\partial_z v, \quad v = \bar{v}, \quad E \in \mathbb{R}.$$

Problem: study the asymptotic behavior of solutions at large times



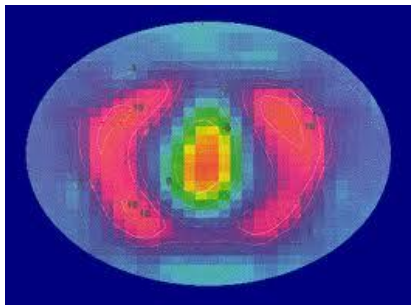
Gelfand-Calderon inverse problem in electronic impedance tomography

Calderon conductivity problem: find conductivity γ in the domain Ω given operator Λ_γ which associates the current flux Λ_γ f on the boundary of Ω to the voltage f on the boundary of Ω

$$\begin{cases} \nabla(\gamma\nabla u) = 0 \quad in\ \Omega, \\ u = f \quad on\ \partial\Omega, \\ \Lambda_\gamma f = \gamma\nabla u \cdot \nu \quad on\ \partial\Omega. \end{cases}$$

Solved via Gelfand inverse problem

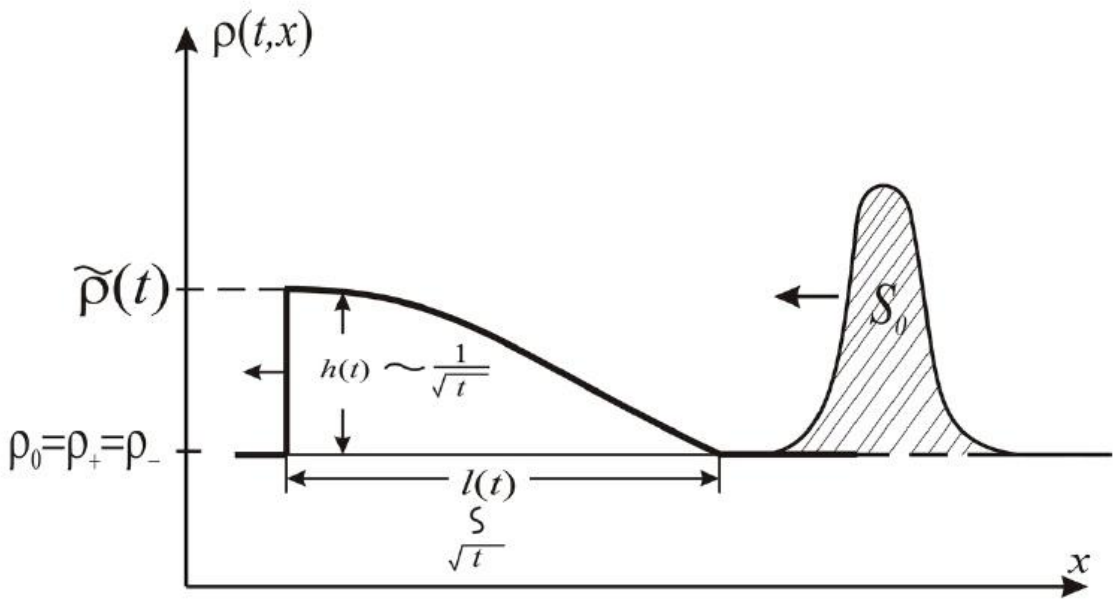
$$\begin{cases} (-\Delta + v)\tilde{u} = 0 \quad in\ \Omega, \\ \tilde{u} = \tilde{f} \quad on\ \partial\Omega, \\ \Lambda_v \tilde{f} = \nabla\tilde{u} \cdot \nu \quad on\ \partial\Omega. \end{cases}$$



Whitham model in the transport flow theory

A.V. Gasnikov

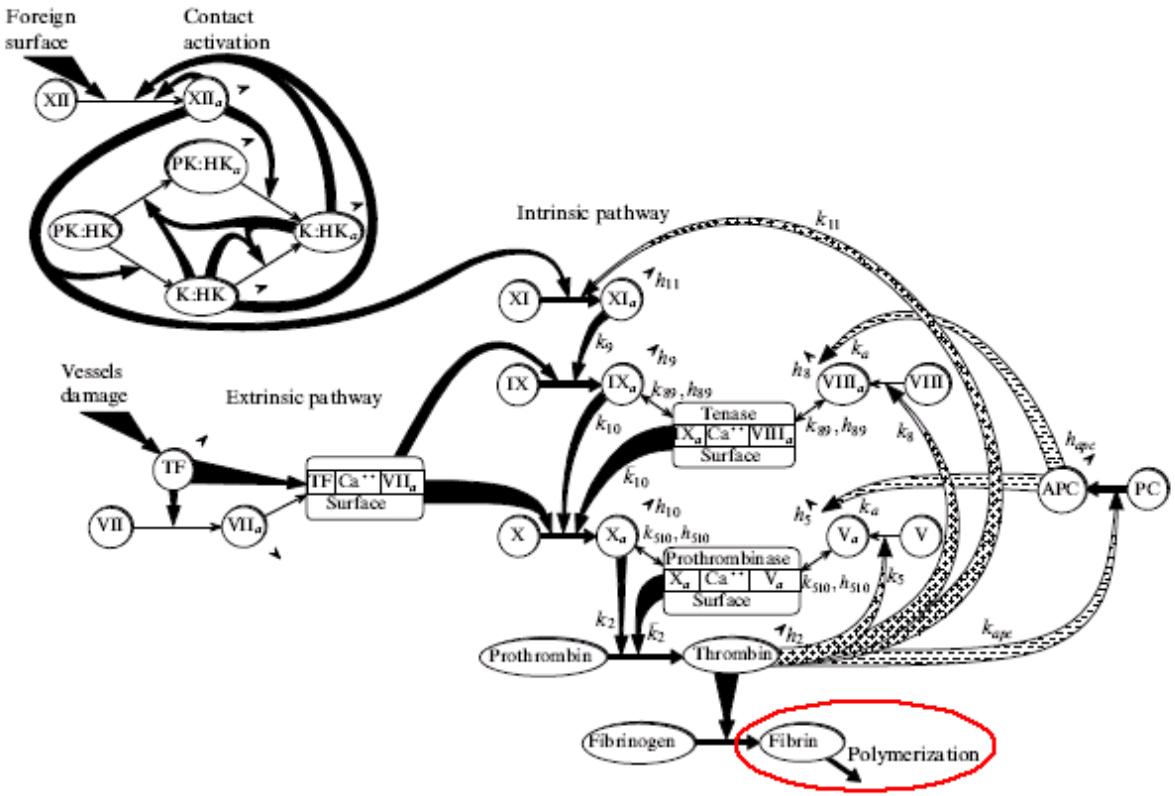
$$\frac{\partial \rho}{\partial t} + \frac{\partial (Q(\rho))}{\partial x} = \frac{\partial}{\partial x}\left(D(\rho) \frac{\partial \rho}{\partial x} \right)$$



Evolution of a local traffic jam

Reaction-diffusion equation applied to modelling of fibrin polymerization

A.I. Lobanov



Reaction-diffusion equation applied to modelling of fibrin polymerization

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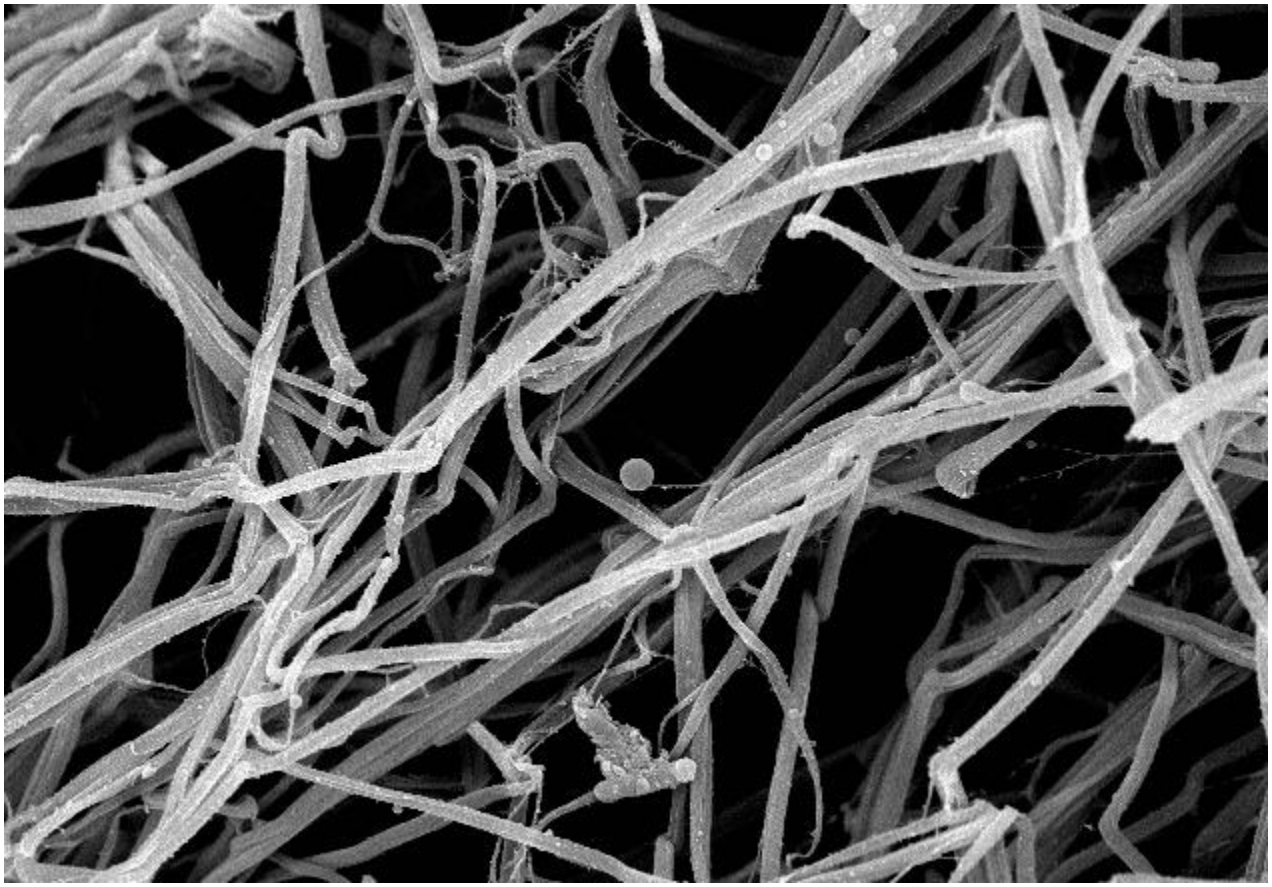
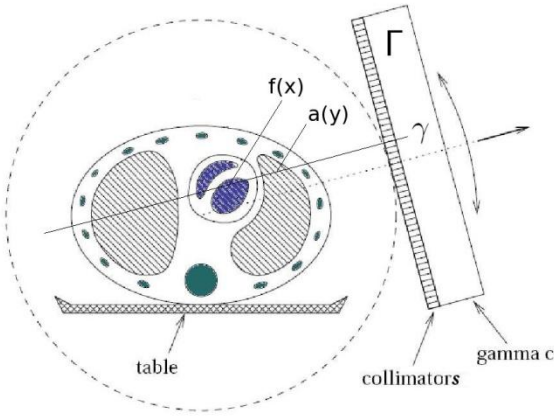
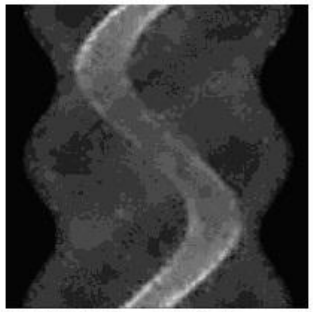


Single-photon emission computed tomography (SPECT)

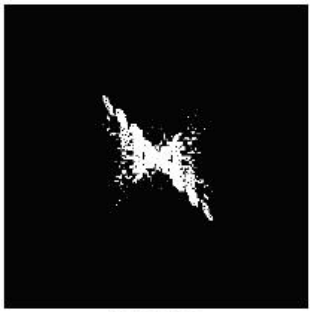
R.G. Novikov



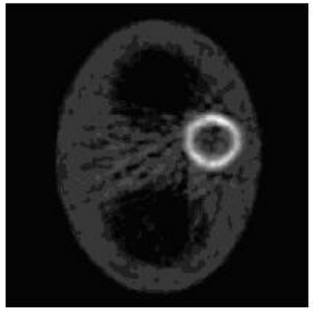
Space-variant Wiener filter $A^{sym}_{8,8}$ and O.A. reconstruction



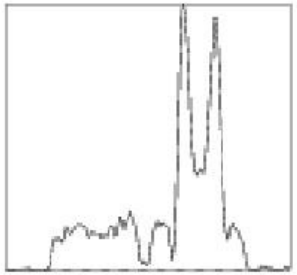
Projections $\|\tilde{p} - g\|_2 / \|g\|_2 = 11\%$



Spectrum



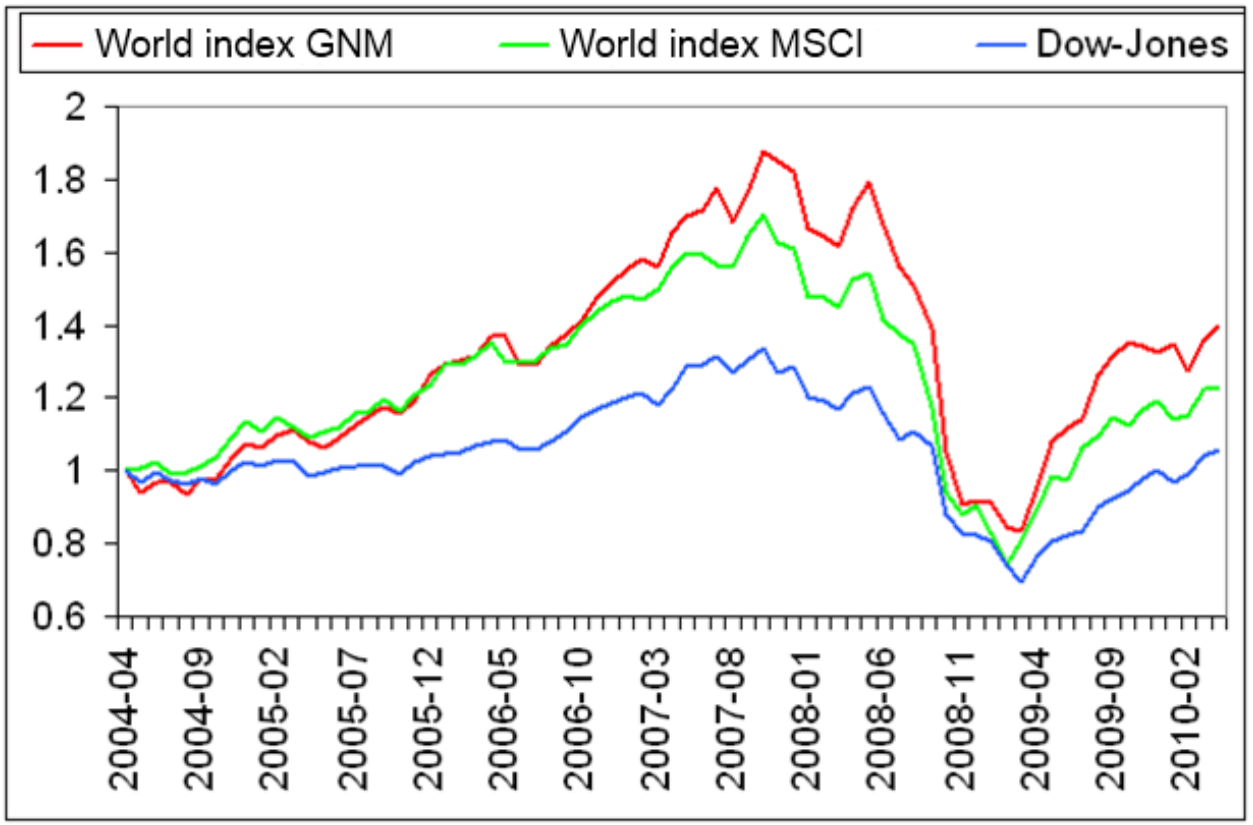
OAR : $\|r - r_0\|_2 / \|r_0\|_2 = 36\%$



Profile

Inverse problems in mathematical economics. Nonparametric method for construction of economic indices

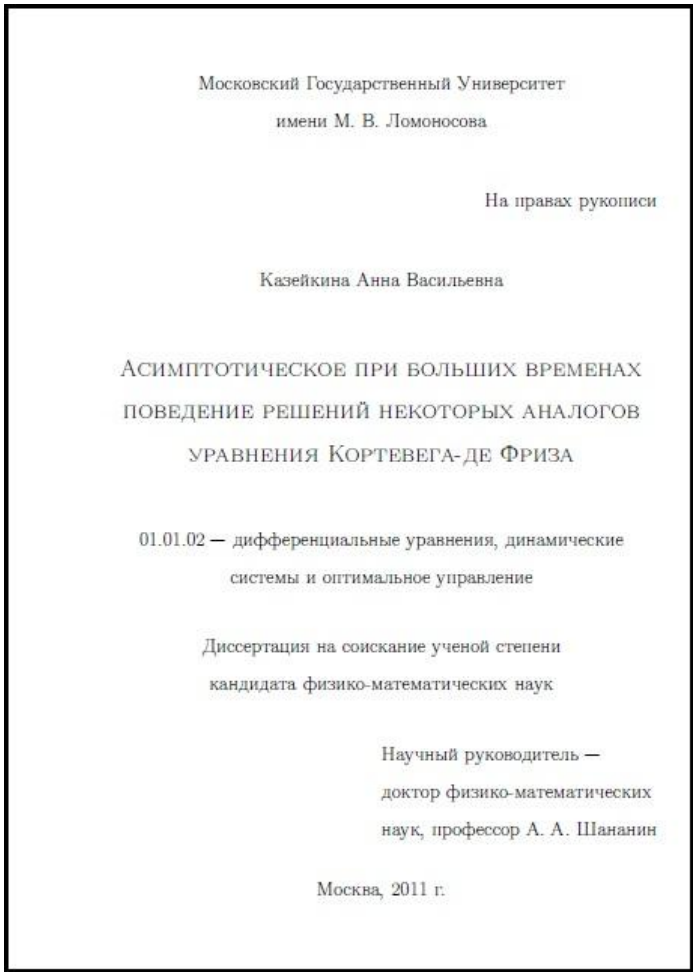
A.A. Shananin



Student exchange

- Internships for Russian master students in Ecole Polytechnique (M.I. Isaev, A.V. Kazeykina); Internships for European students in Moscow Institute of Physics and Technology (M. Santacesaria)
- Joint PhD in France and in Russia (participant of the project M. I. Isaev is currently doing PhD in Moscow Institute of Physics and Technology and in Ecole Polytechnique; participant of the project A.V. Kazeykina has defended a thesis in Moscow State University and a PhD thesis in Ecole Polytechnique)

Joint PhD thesis in Russia (Moscow State University) and France (Ecole Polytechnique)



Московский Государственный Университет
имени М. В. Ломоносова

На правах рукописи

Казейкина Анна Васильевна

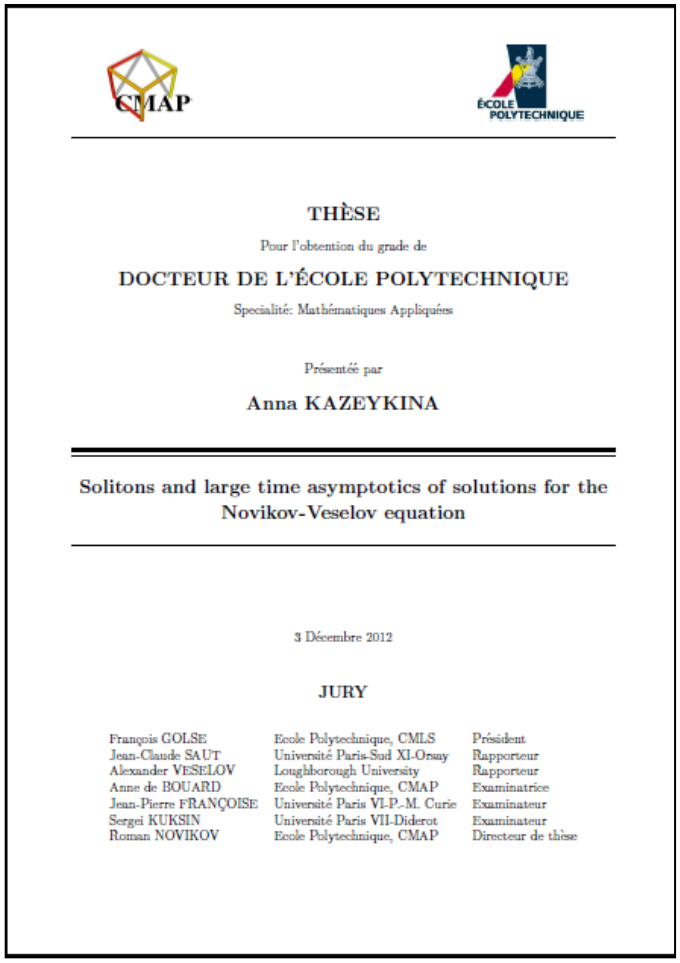
Асимптотическое при больших временах поведение решений некоторых аналогов уравнения Кортевега-де Фриза

01.01.02 — дифференциальные уравнения, динамические системы и оптимальное управление

Диссертация на соискание ученой степени кандидата физико-математических наук

Научный руководитель — доктор физико-математических наук, профессор А. А. Шананин

Москва, 2011 г.



CMAP

ÉCOLE POLYTECHNIQUE

THÈSE

Pour l'obtention du grade de

DOCTEUR DE L'ÉCOLE POLYTECHNIQUE

Specialité: Mathématiques Appliquées

Présentée par

Anna KAZEYKINA

Solitons and large time asymptotics of solutions for the Novikov-Veselov equation

3 Décembre 2012

JURY

François GOLSE	Ecole Polytechnique, CMLS	Président
Jean-Claude SAUT	Université Paris-Sud XI-Orsay	Rapporteur
Alexander VESELOV	Loughborough University	Rapporteur
Anne de BOUARD	Ecole Polytechnique, CMAP	Examinatrice
Jean-Pierre FRANÇOISE	Université Paris VI-P.-M. Curie	Examinateur
Sergei KUKSIN	Université Paris VII-Diderot	Examinateur
Roman NOVIKOV	Ecole Polytechnique, CMAP	Directeur de thèse

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- Kazeykina A.V.: Absence of traveling wave solutions of conductivity type for the Novikov-Veselov equation at zero energy. To appear in Funct. Anal. Appl., arXiv:1106.5639 (2012)
- Kazeykina A.V.: A large time asymptotics for the solution of the Cauchy problem for the Novikov-Veselov equation at negative energy with nonsingular scattering data. Inverse Problems, 28(5), 055017 (2012)
- Kazeykina A.V., Novikov R.G.: Absence of exponentially localized solitons for the Novikov-Veselov equation at negative energy. Nonlinearity. 24, 1821-1830 (2011)
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Publications of M.I. Isaev

- Isaev M.I., Novikov R.G.: New global stability estimates for monochromatic inverse acoustic scattering, arXiv:1210.3821
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- Isaev M.I.: Instability in the Gel'fand inverse problem at high energies, to appear in Applicable Analysis, arXiv:1206.2328
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- Isaev M.I.: Exponential instability in the Gel'fand inverse problem on the energy intervals. Journal of Inverse and Ill-posed Problems. 19(3), 453-473 (2011)