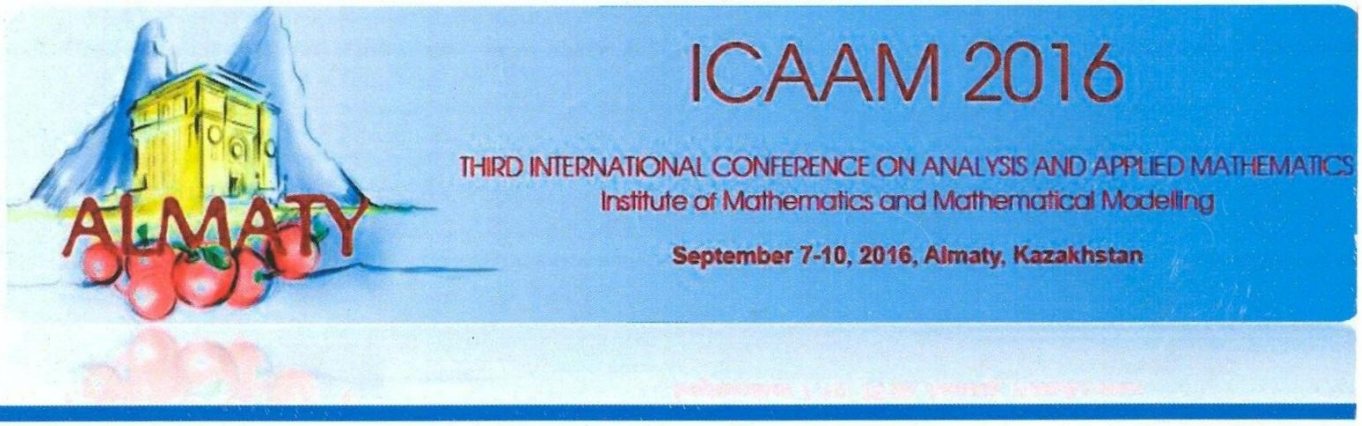
Third International Conference on Analysis and Applied Mathematics

ICAAM 2016

THE ABSTRACT BOOK



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The conference is organized biannually. Previous conferences were held in Gumushane, Turkey in 2012 and in Shymkent, Kazakhstan in 2014.

The aim of the International Conference on Analysis and Applied Mathematics (ICAAM) is to bring mathematicians working in the area of analysis and applied mathematics together to share new trends of applications of mathematics. In mathematics, the developments in the field of applied mathematics open new research areas in analysis and vice versa. That is why, we plan to found the conference series to provide a forum for researches and scientists to communicate their recent developments and to present their original results in various fields of analysis and applied mathematics.

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Conference Sections and Minisymposiums :

- Analysis
- Applied Mathematics
- Mathematics Education
- Other Topics (Algebra, Geometry, Topology...)
- Minisymposium:Mathematical Modelling
- Minisymposium:Spectral Theory of Differential Operators
- Minisymposium:Dynamical Systems

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FOREWORD

The Organizing Committee of ICAAM and Institute of Mathematics and Mathematical Modelling are pleased to invite you to the Third International Conference on Analysis and Applied Mathematics, ICAAM 2016. The meeting will be held on September 7-10, 2016 in Almaty, Kazakhstan. This conference is dedicated to 70th birthday of Prof. Tynysbek Kalmenov.

The conference is organized biannually. Previous conferences were held in Gumushane, Turkey in 2012 and in Shymkent, Kazakhstan in 2014. The proceedings of ICAAM 2012 and ICAAM 2014 were published in AIP (American Institute of Physics) Conference Proceedings. Institute of Mathematics and Mathematical Modelling is pleased to host the third conference which is focused on various topics of analysis and its applications, applied mathematics and modeling.

The conference will consist of plenary lectures, mini symposiums and contributed oral presentations. The proceedings of ICAAM 2016 will be published in AIP (American Institute of Physics) Conference Proceedings. Selected full papers of this conference will be published in peer-reviewed international journals:

- FILOMAT (Science Citation Index),
- BOUNDARY VALUE PROBLEMS (Science Citation Index),
- CONTEMPORARY ANALYSIS AND APPLIED MATHEMATICS.

The aim of the International Conference on Analysis and Applied Mathematics (ICAAM) is to bring mathematicians working in the area of analysis and applied mathematics together to share new trends of applications of mathematics. In mathematics, the developments in the field of applied mathematics open new research areas in analysis and vice versa. That is why, we plan to found the conference series to provide a forum for researches and scientists to communicate their recent developments and to present their original results in various fields of analysis and applied mathematics. The Conference Organizing Committee would like to thank our sponsors. The main organizer of the conference is Institute of Mathematics and Mathematical Modelling, Almaty, Kazakhstan. The conference is also supported by Al-Farabi Kazakh National University, Almaty and L. N. Gumilyov Eurasian National University, Astana, Kazakhstan. We would like to thank Institute of Mathematics and Mathematical Modeling, Al-Farabi Kazakh National University and L. N. Gumilyov Eurasian National University for their support. We alsa would like to thank to all invited speakers, International Organizing Committee, International Organizing Committe, and Technical Program Committee Members. With our best wishes and warm regards,

Chairs:

Prof. Allaberen Ashyralyev

Prof. Mukhtarbay Otelbaev

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TO 70TH ANNIVERSARY

May 2016 was the 70th anniversary of Tynysbek Sharipovich Kal'menov, the outstanding Kazakhstani mathematician, the academician of the National Academy of Sciences of the Republic of Kazakhstan.

He was born in the South-Kazakhstan region of the Kazakh SSR, in the village Koksaek of Lenger district, on May 5, 1946.

Inverse problem for the Verhulst equation of limited population growth with discrete experiment data

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Abstract: Verhulst limited growth model with unknown parameters of growth is considered. These parameters are defined by discrete experiment data. This inverse problem is solved with using gradient method with interpolation of data and without it [1, 2]. Approximation of the delta-function is used for the latter case. As an example the bacteria population *E.coli* is considered.

We consider the evolution of biological species in limited habitat. The given system is described by Verhulst equation. The coefficients of the equations are unknown. We would like to determine it from an inverse problem by using the results of the experiment. The data are distributed discretely. The inverse problem is transformed to an extremum one. This problem is solved by gradient method. The gradient of the given functional depends on the solution of the adjoint system. The adjoint equation includes delta-functions due to the discreteness of the data. This difficulty can be leave out by the interpolation of the data. This inverse problem is solved by using gradient method with interpolation of data and without it. The delta-function is approximated by Gauss formula [3]. The calculation are realized for the exact values of data and with noised data. The calculation accuracy is high enough for both cases and algorithms. We find also the parameters of growth for bacteria population E.coli by real experiment of Scientific Centre of Anti-infectious Drugs (Almaty).

Keywords: Verhulst equation, inverse problem, delta-function

2010 Mathematics Subject Classification: 34A34

References:

[1] Kabanikhin S. (2011). Inverse and Ill-posed Problems. Theory and Applications. Berlin, Boston: De Gruyter, 2011.

[2] Kabanikhin S.I., Shishlenin M.A., Nurseitov D.B. et al. Comparative analysis of methods for regularizing an initial boundary value problem for the Helmholtz equation // Journal of Applied Mathematics, Vol.2014, p. 7, 2014.

[3] Gel'fand I.M., Shilov G.E. Generalized Functions. Properties and Operations, 400p., 1980.

A conditional stability estimate of continuation problem for the Helmholtz equation

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Abstract: In this paper we consider the continuation problem for the Helmholtz equation. The main result is a conditional stability estimate for a solution to the considered problem. The estimate shows that the closer solution to the surface is more stable.

We consider the initial boundary value problem for the Helmholtz equation in the domain $\Omega = (0, l) \times (0, \pi)$ [1]:

$$u_{xx} + u_{yy} + k^2 u = 0, \qquad (x, y) \in \Omega, \tag{1}$$

$$u_x(0, y) = 0, \quad u(0, y) = f(y), \qquad y \in [0, \pi], \tag{2}$$

$$u_y(x, 0) = u_y(x, \pi) = 0, \qquad x \in [0, l], \tag{3}$$

where k, l are given constants. It is required to find a function $u(x, y)$ in Ω from $f(y)$. The main theoretical result is the following

Theorem. Assume that for $f \in L_2(0, \pi)$ there exists a solution $u \in L_2(\Omega)$ to the problem (1) – (3), then the following estimate holds [2]:

$$\|u\|^2(x) \le \left(\|q\|^2 + \left|\|f_y\|^2 - \frac{k^2}{2}\|f\|^2\right|\right)^{\frac{x}{l}} \left(\|f\|^2 + \left|\|f_y\|^2 - \frac{k^2}{2}\|f\|^2\right|\right)^{\frac{l-x}{l}} e^{2x(l-x)} - \left|\|f_y\|^2 - \frac{k^2}{2}\|f\|^2\right|,$$

where $\|u\|^2(x) = \int_0^\pi u^2(x, y)dy$.

Keywords: Helmholtz equation, stability estimate, inverse problem

2010 Mathematics Subject Classification: 35R30

References:

[1] Kabanikhin S., Inverse and Ill-posed Problems. Theory and Applications. Berlin, Boston: De Gruyter, 2011.

[2] Lavrent'ev M.M., Savel'ev L.Y., *Operator Theory and Ill-Posed Problems*, De Gruyter, Germany, 680 p., 2011.