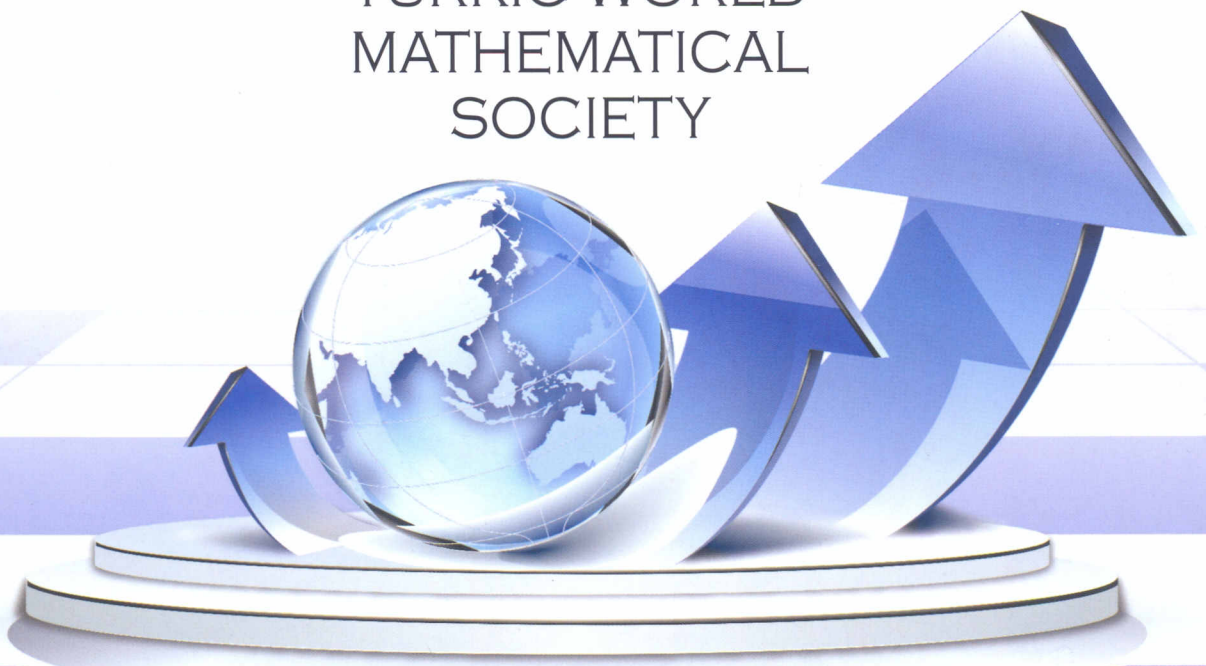
TURKIC WORLD
MATHEMATICAL SOCIETY

BOOK OF ABSTRACTS

IV

CONGRESS OF THE TURKIC WORLD MATHEMATICAL SOCIETY



1-3 JULY 2011
BAKU, AZERBAIJAN

MINISTRY OF EDUCATION OF THE REPUBLIC OF AZERBAIJAN

ABSTRACTS

of the IV Congress of the

TURKIC WORLD MATHEMATICAL SOCIETY

1-3 July, 2011

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The book contains abstract of the participants of the IV Congress of the Turkic World Mathematical Society.

The book will be useful for the specialists in the field of Mathematics and its applications, as well as for the students in Mathematics and Information Technologies.

CONTENTS

Preface

The Turkic World Mathematical Society (TWMS) held its 4th Congress in July 1-3, 2011 in Baku, Azerbaijan. The aim of the Congress was to provide a forum where scientists and mathematicians from academia and industry can meet to share ideas of latest research work in wide branches of mathematics. The Turkic World Mathematical Society (TWMS) was founded in 1999 and unites mathematicians from Turkey, Kazakhstan, Azerbaijan, Kyrgyzstan, Uzbekistan, Turkmenistan and also Russia, Iran, China, USA and European countries. It had been held three congresses of this society since 1999: the First Congress of the TWMS in Firat University (Elazig, Turkey) in 1999, the Second Congress of the TWMS in Sakarya University (Adapazari, Turkey) in 2007, the Third Congress of the TWMS in al-Faraby Kazakh National University (Almaty, Kazakhstan) in 2009.

This issue of abstracts was presented at the IV Congress of the TWMS. The Congress is organized by the Ministry of Education of Azerbaijan Republic, Institute of Applied Mathematics of Baku State University with the collaboration and support of the Azerbaijan National Academy of Sciences. The 562 abstracts presented during three Congress days. More than 650 participants from more than 20 countries including France, Iran, Turkey, Uzbekistan, USA, Russia, Ukraine, Kazakhstan, Turkmenistan, Azerbaijan, Kyrgyzstan, Germany, Latvia, Italy, Czech Republic, India, Pakistan, Spain participated in the Congress. The programm contained 9 invited talks, selected by the International Program Committee, 470 contributions were selected for oral presentation. Congress included 10 topics.

Organizing and Program Committees of the IV Congress of the Turkic World Mathematics Society established competition in three nominations.

1. One award for the best young (under 30) participant's talk.
2. One award for the best talk on theoretical mathematics.
3. One award for the best talk on applied mathematics.

All submitted papers were reviewed by two independent reviewers. The selected papers will be published in: "Applied and Computational Mathematics" (ISSN 1683-3511, indexed in Scopus and in Science Citation Index Expanded, www.science.az/acm), "TWMS Journal of Pure and Applied Mathematics (ISSN 2076-2585)" and "TWMS Journal of Applied and Engineering Mathematics (ISSN 2146-1147). We wish to thank all the authors for their co-operation. We also wish to mention with appreciation the significant role of the reviewers from the international community whose diligent contribution led to the successful completion and publishing of this special edition. Many people contributed time and effort to make the Congress a success: The authors and speakers have prepared a great collection of high-quality contributions, the program committee spent time and effort reviewing the submissions, the members of the organizing committee all took on additional responsibilities, and many student volunteers helped with practical aspects.

We thank the Ministry of Education of Azerbaijan Republic for major funding for the Congress; without their support the meeting can not have taken place. We thank also the Baku State University and the Azerbaijan National Academy of Sciences for his support. I would like to thank the members of the Organizing Committee, the International Advisory Committee, the International Program Committee and the Local Committee for organization and successful passing of the Congress.

Aliev Fikret
Vice-president of TWMS
Editor in Chief

LIST OF AUTHORS

The 4th Congress of the Turkic World Mathematical Society (TWMS) Baku, Azerbaijan, 1-3 July, 2011

THE CALCULATION OF THE LONGITUDINAL-TRANSVERSE SPECTRUM BASED ON NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATION

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In this work the influence of the impact of the strain flow associated with a change of the Reynolds number on the characteristics of isotropic turbulence, and the process of degeneration of isotropic turbulence is considered. Characteristics of turbulence of gas flow or liquid have a great importance for many technical devices [1].

The calculation of the longitudinal-transverse three dimensional energetic spectrum of degeneracy of homogeneous isotropic turbulence is usually produced on the basis of spectral equations and the von Karman-Howarth's equation, for the closure of which it is necessary to determine the correlation functions. When calculating the energy spectrum, is reduced to computational complexity.

In this paper, this problem is solved on the basis of the numerical solution of three-dimensional Navier-Stokes equation by large eddy method on the high-performance cluster. The idea was concluded in specify in the phase space of initial conditions for the velocity field, which satisfies the condition of continuity. At the same time main spectral equation is not solved, and given initial condition with phase space translates into the physical space using a Fourier transform. Obtained velocity field is used as an initial condition for the filtered Navier-Stokes equation. Then we solve three-dimensional nonstationary Navier-Stokes equation for modeling of the degeneration of isotropic turbulence.

To solve the Navier-Stokes equation splitting scheme is used by physical parameters, which consists of three stages. In the first stage Navier-Stokes equation without pressure is solved. To approximate the convective and diffusion terms of this equation compact scheme of high order accuracy is use. In the second stage is solved Poisson's equation, obtained from the continuity equation, taking into account the velocity field from the first stage. For solving the three-dimensional Poisson equation an original algorithm is developed for solving - the spectral transformation in combination with a matrix factorization [2, 3]. The resulting pressure field in the third stage is used to recalculate the final velocity field.

Proposed numerical algorithm allows to calculate changing in the characteristics of isotropic turbulence with high Reynolds numbers. Analyzing the results of modeling can make the following conclusion: One dimensional spectra of the fields were non-negative and monotone, which corresponds to the requirements of the Khinchin's theorem. The viscosity of the flow have a significant effect on the turbulence and therefore can be used for control the turbulence. The obtained results allow us to calculate precisely changing in the characteristics of isotropic turbulence in time, at high Reynolds numbers.

Thus, based on the solution of the Navier-Stokes equations has been constructed a numerical algorithm, allowed to accurately calculate changing in the longitudinal-transverse energy spectrum.

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The 4^{th} Congress of the Turkic World Mathematical Society (TWMS) Baku, Azerbaijan, 1-3 July, 2011

MODELING UNSTABLE STRATIFIED TURBULENT FLOW IN OPEN CHANNELS

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This work considered an unstable stratified turbulent flow in the open channel. Constructed mathematical model allows to simulate the unstable stratified flows and define averages and pulsation characteristics of turbulent flow. Developed the algorithm to solve of the problem and receive results of calculations which well coordinated with the known experiment data.

Unstable stratified turbulent flow is a common type of geophysical flows. The main property of unstable stratified flow is the process of turbulence generation. The basic part of the turbulent energy in stratified flows is generated by the Archimedean buoyancy force. The mechanism of this process is one of the weak-studied problems of atmospheric and ocean science, as it differs from natural convection. In this paper we consider the problem of practical meaning, when the chilled liquid on the surface interacts with the main traffic flow and changes its temperature. In this case, the temperature can not be considered passive, since there is a complex correlation of velocity and temperature.

To study the interaction of velocity and temperature fields, we consider the turbulent flow in the three-dimensional open channel. In order to the problem we use the three-dimensional unsteady Reynolds equation for the motion and the turbulent heat transfer [1].

The system of the equations dares numerically. The splitting method is applied to the decision of the equation of movement on physical parameters where the method of rhythmic steps is applied to a finding components of speed. The equations for temperature dare a method of rhythmic steps by means of the three-step-by-step scheme where on each coordinate implicit difference the equations dares a method of scalar prorace.Vertical speeds is from the indissolubility equation.

The obtained numerical simulation results are compared with experimental data [2]. The results of simulation satisfy to the experimental data. The experiment was conducted in a rectangular tray for different values of Reynolds and Richardson. Unstable stratification was generated by cooling of the free surface, where measurements of the following correlations were made:

$$R_{uv} = \frac{\overline{u_1 u_3}}{-\sqrt{u_1^2}\sqrt{u_3^2}}, \quad R_{ut} = \frac{\overline{u_3 t}}{-\sqrt{u_3^2}\sqrt{t^2}}.$$

Thus, a mathematical model was built that allows simulating the unstable stratified flows to determine average and pulsation characteristics of turbulent flow.

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