

## Preface

International conference Information Technology and Nanotechnology (ITNT-2015) held in Samara at the Samara State Aerospace University.

Languages of the ITNT-2015 Conference: Russian and English.

The goals of the ITNT-2015 Conference are:

- to discuss problems of fundamental and applied researches, computer modeling, development and implementation of information telecommunication systems with leading scientists from Russia, the UK, Germany, Austria, China and India;
- to promote academic and research activities in that direction and to share experiences in teaching IT professionals using innovative educational technology and facilities.

The ITNT-2015 Conference covers a variety of topics related to applications of information technology to aeronautics and astronautics and other branches of high-technology industry.

The major topics of the ITNT-2015 Conference include the following:

- Computer Optics and Nanophotonics
- Mathematical Modeling
- Image Processing and Geoinformatics
- Data Mining and Big Data

The ITNT-2015 Conference has been focused on the educational problems providing opportunities to students and young scientists to become familiar with unique scientific equipment and laboratory facilities in order to achieve scientific results in theory, practice and innovation management according to the major topics of the ITNT-2015 Conference.

Over 200 persons from 7 countries, 15 cities and 27 educational institutions have been participated in the ITNT-2015 Conference. Over 120 reports have been presented.

Proceedings include scientific papers selected by editors on the base of recommendation of Program Committee. The editors accepted 51 articles for publication after the review of the Conference papers.

**Official website of the ITNT-2015 Conference:** <http://agora.guru.ru/itnt-2015>.

# **Organisation**

## **Organizers**

Samara Region Government (<http://www.samregion.ru>)

Samara State Aerospace University (<http://www.ssau.ru>)

Image Processing Systems Institute, Russian Academy of Sciences  
(<http://www.ipsi.smr.ru/>)

## **Organizing Committee**

*Shakhmatov E.V.* (Chairman) Samara State Aerospace University, Samara, Russia

## **Co-Chairpersons**

*Kazarin S.V.* Samara Region Government, Samara, Russia

*Kazanskiy N.L.* Image Processing Systems Institute, Russian Academy of Sciences,  
Samara, Russia

*Kolomiets E.I.* Samara State Aerospace University, Samara, Russia

## **Executive secretary**

*Dodonova N.L.* Samara State Aerospace University, Samara, Russia

## **Organizing Committee (Samara State Aerospace University)**

*Kovartsev A.N.* *Prokhorov S.A.*

*Kudryashov D.V.* *Sergeev V.V.*

*Kupriyanov A.V.* *Fursov V.A.*

*Privalov A.Yu.* *Shchepakina E.A.*

## **Program Committee**

*Soifer V.A.* (Chairman) Samara State Aerospace University, Samara, Russia

*Anshakov G.P.* Joint Stock Company Space Rocket Centre “Progress”, Samara,  
Russia

*Vasin Y.G.* Lobachevsky State University of Nizhni Novgorod, Nizhny Novgorod,  
Russia

*Kazanskiy N.L.* Image Processing Systems Institute, Russian Academy of Sciences, Samara, Russia

*Konov V.I.* Natural Sciences Center, Prokhorov General Physics Institute of RAS, Moscow, Russia

*Kotlyar V.V.* Image Processing Systems Institute, Russian Academy of Sciences, Samara, Russia

*Labunets V.G.* Ural Federal University, Ekaterinburg, Russia

*Rudakov K.V.* Dorodnicyn Computing Centre of the Russian Academy of Sciences, Moscow, Russia

*Ryazhskih V.I.* Voronezh State Technical University, Voronezh, Russia

*Sergeev V.V.* Samara State Aerospace University, Samara, Russia

*Skidanov R.V.* Image Processing Systems Institute, Russian Academy of Sciences, Samara, Russia

*Sobolev V.A.* Samara State Aerospace University, Samara, Russia

*Sokolov B.V.* St. Petersburg Institute for Informatics and Automation of RAS, St. Petersburg, Russia

*Sokolov I.A.* Federal Research Center "Informatics and Control", Russian Academy of Sciences, Moscow, Russia

*Mau Jochen.* Heinrich-Heine-University, Dusseldorf, Germany

*O'Faolain Liam.* University of St. Andrews, St Andrews, Scotland, United Kingdom

*Sazhin Sergei.* University of Brighton, Brighton, United Kingdom

*Sverdlov Victor.* Vienna University of Technology, Vienna, Austria

**Editors**

*Kazanskiy N.L.*

*Skidanov R.V.*

*Popov S.B.*

*Sobolev V.A.*

*Sergeev V.V.*

**Editor release**

*Kudryashov D.V.*

## Table of Contents

### Computer Optics and Nanophotonics

1.	On the 70th birthday of corresponding member of the Russian Academy of Sciences Victor A. Soifer.....	1-8 <i>Sokolov V.O.</i>
	DOI: 10.18287/1613-0073-2015-1490-1-8	
2.	Optical trapping of air-borne light-absorbing particles with various laser beams.....	9-16 <i>Porfirev A.P.</i>
	DOI: 10.18287/1613-0073-2015-1490-9-16	
3.	Diffraction lens in imaging spectrometer.....	17-26 <i>Blank V.A., Skidanov R.V.</i>
	DOI: 10.18287/1613-0073-2015-1490-17-26	
4.	Diffraction by an axicon with taking into consideration multiple internal reflections.....	27-36 <i>Degtyarev S.A., Ustinov A.V., Khonina S.N.</i>
	DOI: 10.18287/1613-0073-2015-1490-27-36	
5.	Calculation of mode set in weakly guiding fibers.....	37-44 <i>Alexandrova A.V.</i>
	DOI: 10.18287/1613-0073-2015-1490-37-44	
6.	Modeling superlattice patterns using the interference of sharp focused spherical waves.....	45-52 <i>Fidirko N.S.</i>
	DOI: 10.18287/1613-0073-2015-1490-45-52	
7.	Diffractive optical elements for capturing and controlled rotation of micro-objects.....	53-60 <i>Ganchevskaya S.V., Skidanov R.V.</i>
	DOI: 10.18287/1613-0073-2015-1490-53-60	
8.	Study of the chromatic properties of harmonic diffractive lens.....	61-68 <i>Kovalenko A.I.</i>
	DOI: 10.18287/1613-0073-2015-1490-61-68	
9.	Modeling of the propagation of Bessel beams in an uniaxial crystal at different positions of the crystal axis.....	69-81 <i>Krasnov A.P.</i>
	DOI: 10.18287/1613-0073-2015-1490-69-81	

10. Laser ablation of thin films of molybdenum for the fabrication of contact masks elements of diffractive optics with high resolution.....82-89  
*Poletaev S.D.*  
DOI: 10.18287/1613-0073-2015-1490-82-89
11. The research of the properties of thin films of molybdenum to form the contact masks for diffractive optics elements.....90-96  
*Poletaev S.D.*  
DOI: 10.18287/1613-0073-2015-1490-90-96
12. Simulation of linear gradient lenses for subwavelength focusing of Gaussian beams.....97-104  
*Savelyev D.A.*  
DOI: 10.18287/1613-0073-2015-1490-97-104
13. Modeling of propagation of optical signals in gradient index media based on fractional Fourier transform.....105-111  
*Zubtsov R.O., Kirilenko M.S.*  
DOI: 10.18287/1613-0073-2015-1490-105-111
14. Vibration resistance of headlight design for electric locomotive.....112-121  
*Abulkhanov S.R.*  
DOI: 10.18287/1613-0073-2015-1490-112-121
15. Vibration resistance of headlamp design with light emitting diodes for electric locomotive.....122-132  
*Abulkhanov S.R., Skuratov D. L.*  
DOI: 10.18287/1613-0073-2015-1490-122-132
16. Correction of parameters of fiber-optical systems on the basis of the magneto tunable gradient elements.....133-137  
*Leonovich G.I., Karpeev S.V., Paranin V.D.*  
DOI: 10.18287/1613-0073-2015-1490-133-137
17. Analysis of activity of the scientific journal *Computer Optics*.....138-150  
*Kolomiets E.I.*  
DOI: 10.18287/1613-0073-2015-1490-138-150
18. Asymptotic research in computer optics.....151-161  
*Kazanskiy N.L.*  
DOI: 10.18287/1613-0073-2015-1490-151-161
19. Modeling and identification of centered crystal lattices in three-dimensional space.....162-170  
*Kirsh D.V., Kupriyanov A.V.*  
DOI: 10.18287/1613-0073-2015-1490-162-170

20. Spectrum of spatial frequency of terahertz vortex Bessel beams formed using phase plates with spiral zones.....171-178  
*Zhabin V.N., Volodkin B.O., Knyazev B.A., Mitkov M.S., Pavelyev V.S., Choporova Yu.Yu.*  
DOI: 10.18287/1613-0073-2015-1490-171-178

## Mathematical Modeling

21. Critical phenomena in a model of fuel's heating in a porous medium.....179-189  
*Shchepakina E.A.*  
DOI: 10.18287/1613-0073-2015-1490-179-189
22. Canards and the effect of apparent disappearance.....190-197  
*Sobolev V.A.*  
DOI: 10.18287/1613-0073-2015-1490-190-197
23. Numerical simulation of the resonance effect at re-entry of a rigid body with low inertial and aerodynamic asymmetries into the atmosphere.....198-210  
*Lyubimov V.V.*  
DOI: 10.18287/1613-0073-2015-1490-198-210
24. Numeric simulation of the interaction between subsonic flow and a deformable profile blade on the compressor experiment phase.....211-218  
*Mekhonoshina E.V., Modorskii V.Ya., Petrov V. Yu.*  
DOI: 10.18287/1613-0073-2015-1490-211-218
25. Simulation of DTN nodes' mobility using least action principle for locations selection .....219-226  
*Privalov A.Yu., Tsarev A.A.*  
DOI: 10.18287/1613-0073-2015-1490-219-226
26. On some applications of one wave equation with variable coefficients.....227-233  
*Senitskiy A.Yu., Evdokimova N.N.*  
DOI: 10.18287/1613-0073-2015-1490-2287-233
27. An adaptive mesh refinement in the finite volume method.....234-241  
*Avdeev E.V., Fursov V.A., Ovchinnikov V.A.*  
DOI: 10.18287/1613-0073-2015-1490-234-241
28. Application of fast discrete wavelet transformation on the basis of spline wavelet for loosening correlation of sequence of data in mass service theory .....242-245  
*Blatow I.A., Gerasimova U.A., Kartashevskiy I.V.*  
DOI: 10.18287/1613-0073-2015-1490-242-245

29. Structure and algorithms of motion control system's software of the small spacecraft.....246-251

*Filatov A.V., Tkachenko I.S., Tyugashev A.A., Sopchenko E.V.*

DOI: 10.18287/1613-0073-2015-1490-246-251

30. Method of UNIT testing for computing software modules algorithms...252-261

*Kovartsev A.N., Popova-Kovartseva D.A., Gorshkova E.E.*

DOI: 10.18287/1613-0073-2015-1490-252-261

## **Image Processing and Geoinformatics**

31. The enhancement of the operating speed of the algorithm of adaptive compression of binary bitmap images.....262-267

*Borusyak A.V.*

DOI: 10.18287/1613-0073-2015-1490-262-267

32. 3D scene stereo reconstruction with the use of epipolar restrictions....268-276

*Fursov V.A., Goshin Y.V.*

DOI: 10.18287/1613-0073-2015-1490-268-276

33. Computer-aided system of data protection by steganography methods .....277-284

*Kiseleva A.V., Kudrina M.A.*

DOI: 10.18287/1613-0073-2015-1490-277-284

34. Development of parallel implementation for the dendritic crystallograms modeling algorithm.....285-289

*Paringer R.A., Kupriyanov A.V.*

DOI: 10.18287/1613-0073-2015-1490-285-289

35. Researching methods of reconstruction of three-dimensional crystal lattice from images of projections .....290-297

*Shirokanov A.S., Kirsh D.V., Kupriyanov A.V.*

DOI: 10.18287/1613-0073-2015-1490-290-297

36. Information-theoretic preprocessing method for computer vision systems.....298-303

*Tananykina L.V.*

DOI: 10.18287/1613-0073-2015-1490-298-303

37. Research and development of the classification algorithm based on the method of reference planes.....304-308

*Goshin Ye.V., Loshkareva G.E., Fursov V.A.*

DOI: 10.18287/1613-0073-2015-1490-304-308

38. Analysis of the scientific and organizational results of the Image Processing Systems Institute of the RAS.....309-326

*Kolomiets E.I.*

DOI: 10.18287/1613-0073-2015-1490-309-326

## Data Mining and Big Data

39. Challenges of data access in economic research based on  
Big Data technology.....327-337  
*Chumak V.G., Ramzaev V.M., Khaimovich I.N.*  
DOI: 10.18287/1613-0073-2015-1490-327-337
40. Philosophic aspects of developing new knowledge under data  
intellectual analysis (Big Data).....338-345  
*Bodrov A.A., Ramzaev V.M.*  
DOI: 10.18287/1613-0073-2015-1490-338-345
41. The Big Data mining to improve medical diagnostics quality.....346-354  
*Ilyasova N.Yu., Kupriyanov A.V.*  
DOI: 10.18287/1613-0073-2015-1490-346-354
42. Modern aspects in development of branch applications on the basis  
of Big Data: possibilities, prospects and limitations.....355-363  
*Ramzaev M.V.*  
DOI: 10.18287/1613-0073-2015-1490-355-363
43. Development of the requirements template for the information support  
system in the context of developing new materials involving Big Data.....364-375  
*Grechnikov F.V., Khaymovich A.I.*  
DOI: 10.18287/1613-0073-2015-1490-364-375
44. Automated detection system of insider attacks using fuzzy logic.....376-380  
*Dodonov M.V., Dodonova N.L.*  
DOI: 10.18287/1613-0073-2015-1490-376-380
45. Developing methods and algorithms for a decision-making  
intellectual support in personnel management systems.....381-388  
*Danilenko A.N.*  
DOI: 10.18287/1613-0073-2015-1490-381-388
46. Software testing based on global search of several variables  
functions discontinuity.....389-396  
*Kovartsev A.N., Popova-Kovartseva D.A., Gorshkova E.E.*  
DOI: 10.18287/1613-0073-2015-1490-389-396
47. Technique of measurement of ultra-low resistance of current conductive  
junction of rail lines as the problem of states object identification.....397-401  
*Tarasov E.M., Isaicheva A.G.*  
DOI: 10.18287/1613-0073-2015-1490-397-401

48. The concept of «range» used in experimental calculations.....402-405  
*Yablokova L.V.*  
DOI: 10.18287/1613-0073-2015-1490-402-405
49. Recovery of directed graphs from the matrix  
of peaks neighborhood.....406-413  
*Kotenko A.P., Dokuchaev A.V.*  
DOI: 10.18287/1613-0073-2015-1490-406-413
50. GPU implementation of Jacobi method for data arrays  
that exceed GPU-dedicated memory size.....414-419  
*Kochurov A.V., Vorotnikova D.G., Golovashkin D.L.*  
DOI: 10.18287/1613-0073-2015-1490-414-419
51. The Big Data methodology in computer vision systems.....420-425  
*Popov S.B.*  
DOI: 10.18287/1613-0073-2015-1490-420-425