

**Ministry of Education and Science of the Russian Federation  
Bauman Moscow State Technical University  
Scientific and Educational Division «Fundamental Sciences»**

**Russian National Committee on Theoretical and Applied Mechanics  
The State Duma Committee on Education of the Russian Federation  
Moscow Physical Society of the Russian Federation  
Moscow Gravitational Society**

**International Scientific Conference**

# **Physical and Mathematical Problems of Advanced Technology Development**

*devoted to the 50th Anniversary of the Scientific and Educational Division  
«Fundamental Sciences» of the Bauman Moscow State Technical University*

**ABSTRACTS  
OF INTERNATIONAL SCIENTIFIC CONFERENCE  
PHYSICAL AND MATHEMATICAL PROBLEMS OF  
ADVANCED TECHNOLOGY DEVELOPMENT**

**Moscow, 17 – 19 November, 2014**

**Moscow, 2014**

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This volume contains abstracts which accepted for inclusion in the programme of lectures of meeting “Physical and Mathematical Problems of Advanced Technology Development” which is organized by the Bauman Moscow State Technical University.

The conference is to take place at the time of the 50<sup>th</sup> anniversary celebration of the Scientific and Educational Division «Fundamental Sciences» of the Bauman Moscow State Technical University. The division is the major unit of the BMSTU. It comprises physical and mathematical departments, the history of which is closely connected with the history of BMSTU.

The lectures of the PHYSMATHTECH-2014 includes papers dealing with the following major themes:-

The current trends in machine science and machine operating processes.

Advanced research and technology of irreversible processes in physics and astrophysics.

High-precision physical experiment.

Mathematical simulation in the control science.

Mathematical research techniques of non-stationary processes.

Mathematical models of continuum mechanics.

Challenges of computational mechanics and computer simulation techniques.

Fundamental problems of advanced technology development.

Scientific and methodological approaches to science teaching.

The programme timetable, giving authors and titles of papers as presented and other details of the Moscow Meeting “This volume contains abstracts which accepted for inclusion in the programme of lectures of meeting “Physical and Mathematical Problems of Advanced Technology Development” are given on the web site maintained by the Bauman Moscow State Technical University

<http://fn.bmstu.ru/index.php/en/nuk-fn/news/103-nuk-fn/novosti/426-physmathtech2014>

The meeting is intended to be of interest to physicists, mathematicians, engineers, philosophers and historians of science, post-graduate students.

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проведен численный расчет долговечности и надежности двухслойной охлаждаемой конструкции корпуса тепло-энергетической двигательной установки.

### **Computational solution of conjugated problem of hypersonic air-dynamics and thermomechanics of thermodecomposition structures**

Dimitrienko Yu.I., Zaharov A.A., Koryakov M.N., Stroganov A.S.

The coupled problem statement for aero-gas-dynamics, internal heat-mass-transfer and thermostrength of thermoprotective structures of hypersonic aircrafts has been formulated. The method for numerical solving the problem has been suggested, which is based on introducing two time scales: a slow time corresponding to a typical time of heat propagation in a coating structure of the aircraft and a fast time corresponding to a typical time of establishing the exterior aerodynamic flow. Examples of numerical solution of the coupled problem of aero-gas-dynamics and thermostrength of elements of thermoprotective structures of advanced aircrafts are given. It is shown that due to high temperatures of aerodynamic heating of structures made of polymer composite materials there can occur a thermodecomposition because of the polymer phase thermodecomposition and intensive internal gas generation in the structure materials.

### **Численное моделирование сопряженных процессов аэрогазодинамики, теплообмена и термодеструкции конструкций высокоскоростных летательных аппаратов**

Димитриенко Ю.И., Захаров А.А., Коряков М.Н., Строганов А.С.

*Московский государственный технический университет им. Н.Э. Баумана, Москва, Россия*

Сформулирована постановка сопряженной задачи аэрогазодинамики, внутреннего тепломассопереноса и термострочности теплозащитных конструкций гиперзвуковых летательных аппаратов. Предложен метод численного решения этой задачи, основанный на введении двух временных масштабов - "медленного" времени, соответствующего характерному времени распространения тепла в конструкции оболочки летательного аппарата, и "быстрого" времени, соответствующего характерному времени установления внешнего аэродинамического потока. Представлены примеры численного решения сопряженной задачи аэрогазодинамики и термострочности элементов теплозащитных конструкций перспективного летательного аппарата. Показано, что вследствие высоких температур аэродинамического нагрева конструкций из полимерных композиционных материалов в них может происходить терморазрушение из-за термодеструкции полимерной фазы и образования интенсивного внутреннего газообразования в материалах конструкции.

### **Validation study of gas mixture propagation in hydrogen safety applications**

Golibrodo L.A., Krutikov A.A., Nadinsky Yu.N., Nikolaev A.V., Skibin A.P., Zorina I.G., Volkov V.Yu.

Most accidents involving hydrogen begins with its leakage and spreading in the air and spontaneous detonation, which is accompanied by a fire or deflagration of hydrogen mixture with heat and /or shocks, which may cause harm to life and equipment.

Outflow of hydrogen in a confined volume and its propagation in the volume is the worst option because of the impact of the insularity on the process of detonation. According to the safety requirements for handling hydrogen a ventilation system is required for maintaining the

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**Тезисы  
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