

**Proposal for cooperation
of Department 'Control Systems and Processes'
NTU 'KhPI'**



Department 'Control Systems and Processes'



Specialties:

- Applied Mathematics
- Computer Science and Information Technologies

Scientific research themes:

- Nonlinear solid mechanics, in particular – creep and long-term strength of materials and structural elements under cyclic loading and heating.
- Long-term strength of structural elements at dynamic and impact loading.
 - Development of software for engineering calculations.
 - Control of spaceships orientation and navigation systems.

Head of the Department, Prof., Dr.Tech.Sc. – Breslavsky Dmitry
E-mail: brdm@kpi.kharkov.ua

The most significant results in scientific activity:

The theory of the cyclic and dynamic creep-damage processes in materials and structural elements is created, verified and used in special Finite Element Method software which were developed in 2001-2015 in the Department of Control Systems and Processes. A part of the work was awarded by

**CEGB prize 2001 (United Kingdom) for the best paper in
Journal of Strain Analysis for Engineering Design**

(H. Altenbach, D. Breslavsky, O. Morachkovsky, K. Naumenko. Cyclic Creep-Damage in Thin-Walled Structures // Journal of Strain Analysis for Engineering Design. - London, 2000. - Vol.35, No 1. - P. 1-11.).

Paper summarized the results which were obtained in joint projects with professors Altenbach and Naumenko (DAAD 1997-1999).

The joint work is continued. Just now (2015-2016) the results of the common investigations deals with the use of Armstrong-Frederick equations in order to simulate the creep-damage processes in materials with recovery in creep properties are obtained.

Participation in international projects:

- Acting 'Agreement of Cooperation in scientific research' between Department of Control Systems and Processes NTU 'KhPI' and Department of Technical Mechanics Magdeburg Otto von Guericke University (2014-2017)
 - Joint research project between NTU 'KhPI' and KHARTRON-ARKOS (Kharkiv) and Beijing Research Institute of Automatic Space Control (China)
 - International startup competition Sikorsky Challenge 2015 with project "Development of the technology for miniature satellite navigation system"
 - European Satellite Navigation Competition 2016 with project "NaviGO: low-cost mini navigation system for UAV with autonomous mode flight control"
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Publications in Scopus:

- Breslavskii D.V. Anisotropic creep and damage in structural elements under cyclic loading / D.V. Breslavskii, V.A. Metelev, O.K. Morachkovskii // Strength of Materials. – 2015. Vol. 47, № 2. – P. 235-241.
 - Breslavsky D.V. Creep and damage in shells of revolution under cyclic loading and heating / D.V. Breslavsky, O. Morachkovsky, O. Tatarinova // International Journal of Nonlinear Mechanics. – 2014. # 66 – P. 87-95.
 - Zlatkin O.Yu. The development of a high-precision strapdown inertial system based on medium-accuracy fiber-optic gyroscopes for rocket and space applications / O.Yu. Zlatkin, S.V. Oleynik, A.V. Chumachenko, (...), V.B. Uspensky, A.V. Gudzenko // 21st Saint Petersburg International Conference on Integrated Navigation Systems, ICINS 2014. – Proceedings.
 - Kolyadin S. Developing a fault-tolerant high precision strapdown ins using redundant medium-accuracy gyroscopes / S. Kolyadin, E. Bochkova, A. Zhikhareva, (...), K. Schastlivec, V. Uspensky // 21st Saint Petersburg International Conference on Integrated Navigation Systems, ICINS 2014. – Proceedings.
 - Vahitov T.N. An NSI-2000MTG integrated navigation system / T.N. Vahitov, A.B. Kolchev, K.Y. Schastlivets, V.B. Uspensky, (...), P.V. Larionov, A.A. Fomitchev // Gyroscopy and Navigation. – 2013. Vol. 4, No. 2. - P. 69–78.
 - Kolyadin S.A. Strapdown inertial navigation system BINS-05: Basic technical and algorithmic solutions, flight results / S.A. Kolyadin, D.A. Rekunov, A.E. Fedorov, (...), K.Yu. Schastlivets, V.B. Uspensky // 20th Saint Petersburg International Conference on Integrated Navigation Systems, ICINS 2013 - Proceedings.
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Proposals for joint research

The joint project
“Deformation and Long Term Strength of Spacecraft Structural Elements”
is suggested.

The aim of the project is the development of methods, algorithms and specialized software for numerical simulation of the structural elements of satellites, missiles and their parts considering the complex influence of varied stress and temperature fields and space irradiation.

The new approaches for the analysis of the stress-strain state and damage distribution in spacecraft structures considering long term properties variation will be developed. The deformed state of the trusses, devices platforms, fiber optic gyroscopes etc will be determined in order to avoid the errors in the high-precision on-board hardware, e.g. Earth remote sensing equipment. The methods of this equipment validation and calibration analyzing the data of possible thermal and irreversible strains will be developed.

The results of the work can be used in design stages of modern spacecraft equipment in Ukrainian (KHARTRON, Yangel Yuzhnoe SDO) and European aerospace organizations.
