

COMPREHENSIVE QUALITY ASSURANCE OF TRANSPORT AND TECHNOLOGICAL MACHINES AND DEVICES

Founded in 1997.

*Head of the research group: **Igor Iosifovich ARTEMOV**, Doctor of Engineering Sciences, Professor, Honoured Worker of Science of the Russian Federation, Honoured Worker of Higher Vocational Education of the Russian Federation, Full Member of the Russian Public Academies for Transport and Educational Informatisation.*

Members of the research group: **S. V. Seynov**, Doctor of Engineering Sciences, Professor; **E. A. Chufistov**, PhD in Engineering, Professor; S. V. Sumenkov, PhD in Engineering, Associate Professor; A. V. Dryazgin, PhD in Engineering, Associate Professor; M. A. Cheremshanov, PhD in Engineering, Associate Professor; **A. A. Voynov**, PhD in Engineering, Associate Professor; V. S. Chernikov, PhD in Engineering, Associate Professor; S. A. Sorokin, PhD in Engineering, Associate Professor (Nizhni Novgorod); A. A. Generalova, PhD in Engineering, Associate Professor; S. A. Nesterov, PhD in Engineering, Associate Professor; **A. E. Zverovshchikov**, Doctor of Engineering Sciences, Professor.

I. I. Artemov, the group's head, is an organiser of university training programmes in transport engineering. At PSU, he initiated Bachelor and Master degree programmes in Land Transport Systems as well as Specialist degree programmes in Automotive and Tractor Industry; Automotive Service; Automotive Electronics Service; Lifting, Building, and Road Machines and Equipment. The research group's members initiated 5 training laboratories, namely Automobile Design, Tractor Design, Internal Combustion Engines, Technological Design Informatics in Mechanical Engineering, and Road Traffic Safety Organisation.

One of the main initial focuses of the group was the development of a priority research area in precision assurance in mechanical engineering. This resulted in the establishment of functional interrelationships of errors caused by machining and occurring during operation. These research outcomes were subsequently validated by the USSR Academy of Sciences Institute of Mechanical Engineering and Bauman Moscow Higher Technical School and formed the basis for developing standards for gear precision assurance.

The further development of the selected research area has been related to comprehensive precision assurance of automated manufacturing of parts in mechanical engineering.

Within the framework of the group's research area, the following works have been accomplished: comprehensive precision and performance assurance of shafts, gear transmissions and tightening stability of threaded joints, fretting resistance of threaded joints; prediction of wear resistance of heavily loaded hydrodynamic sliding bearings; and integrated quality assurance of internal combustion engine performance. The group has published numerous articles on these topics, received copyright certificates and patents.

The group has conducted the following studies assigned by the Ministry of Education and Science of the Russian Federation: *Integrated Quality Assurance in Flexible Computer-Aided Manufacturing* and *Scientific Foundations for Constructing the System of Integrated Quality Assurance of Mechanical Engineering Products*.

The group's members took part in the development of a training and research complex of laboratory equipment and in the research into operation parameters in internal combustion engines as part of the scientific and technological programme in *Scientific, Methodological, Logistical, and Information Support of the Educational System*.

The work in quality assurance of transport and process equipment resulted in the design and production a forklift for OJSC AMO ZiL as well as in the design a snowplough for household use.

Led by **I. I. Artemov**, the research group has developed an electric vehicle equipped with a real-time tracking system for flying objects (drones). Electric equipment allows the replacement of an internal combustion engine in production cars such as UAZ, LuAZ, and similar models with an electric one, while retaining a standard transmission and braking system. The main advantage of the electric car is its quiet engine and silent operation. The project is expected to lead to the development of unmanned electric vehicles with remote-controlled radar systems capable of operating at significant distances from the tracked object.

Supervised by S. A. Nesterov, PhD in Engineering, Associate Professor, the project of the *Staircase Mobility Vehicle for People with Disabilities* has been implemented at Tarkhany Reserve.

Led by **I. I. Artemov**, the research group's project titled the Hydrogenation Reactor for Flow Synthesis led to the development of a modern import-substituting hydrogenation reactor for the chemical industry – unique in the Russian Federation. A flexible technological base has been also established for the design, development, and production of complex high-tech parts and assemblies of chemical industry equipment. New methodologies have been developed for creating high-temperature synthesis equipment for output fractions using hydrogen with a purity level of 99%.

In accordance with the main research area of the group, its studies are focused on the following:

- Development of system provisions for comprehensive precision assurance of production and repair of transport and processing equipment based on scientific standardisation of physical and mathematical values as well as technological and metrological support.

- Development of structural, mathematical, physical, and technological models that represent the properties of the transport and processing machine at various stages of its lifecycle and enable the calculation of quality indicators.

- Development of theoretical and experimental research methods for transport and processing machines aimed at identifying factors affecting the condition of sealing frictional mating parts, loads in the gate valve, sealing quality, and other parameters.

In 2008, a research laboratory for *Nanotechnologies and Information Technologies in Mechanical Engineering* was established in response to a request from the Institute for Design-Technological Informatics, part of the Department of Nanotechnology and Information Technologies of the Russian Academy of Sciences.

In recent years, a promising area in mechanical engineering – the fabrication of nanostructured surfaces for transport and processing machine components with enhanced physical and mechanical properties – has been actively developed.

Since 1995, international and national research and technological conferences have been held annually under the auspices of the research group.

The research group's members serve on the editorial boards of journals such as *Proceedings of Universities. The Volga Region. Engineering Sciences, New Industrial Technologies*, and *Engineering Journal. Guide*.

The research group has established research collaborations with Russian universities such as Moscow Polytechnic University, Moscow State University of Technology "STANKIN", Yuri Gagarin State Technical University of Saratov, Tomsk State University, Komsomolsk-na-Amure State University, Lipetsk State Technical University, and Kalashnikov Izhevsk State Technical University. The range of the group's scientific interests also extends to industrial enterprises in Penza and the Penza Region.

The group collaborates with international research groups from Politehnica University of Timișoara (Romania) and Lublin University of Technology (Poland).

Members of the research school have published over 900 printed works, including over 100 inventor's certificates and patents. The group has received numerous state awards, diplomas, and medals for their research outcomes.

The research group has supervised and defended 12 PhD dissertations and 3 Doctor of Sciences dissertations.



■ An electric vehicle equipped with a Radeksan-Antidrone system



■ A prototype of a continuous-flow hydrogenation reactor