Interview with Prof. L.M. Lobanov, the Deputy Director of the E.O. Paton Electric Welding Institute

Over the whole period of activity of the E.O. Paton Electric Welding Institute a great attention is paid to the creation of highly-efficient welded structures. Nowadays this direction of works is headed by Prof. Leonid M. Lobanov, the academician of the NAS of Ukraine, honored worker of science and technology of Ukraine. His scientific activity is associated with the fundamental and applied research works in the field of materials science, strength of materials and welded structures. His works are devoted to investigations of behavior of materials in welding, development of theory of welding stresses and deformations and methods of investigation and regulation of stress-strain states of welded joints, creation of welded structures of new engineering, development of methods and means of their non-destructive testing and diagnostics.

The research and development works, performed by L.M. Lobanov and the team under his supervision, were distinguished by a number of prizes:

1981 — the Prize of the Council of Ministers of the USSR for development and implementation of new physical methods for study and improvement of metallurgical processes and structures of new engineering;

1994 — the State Prize of Ukraine in the field of science and technology for the series of scientific works on theory of calculations of spatial structures and erections at static and dynamic loads;

2004 — the Evgeny Paton Prize for the series of works in the field of strength, diagnostics and life extension of welded structures.

L.M. Lobanov published over 700 scientific papers, including 80 authors' certificates and patents, prepared 9 Doctors of Technical Sciences and 16 Candidates of Technical Sciences, he was awarded the Orders of Merit of the First, the Second and the Third Class, as well as the Order of the Badge of Honor and was distinguished with the NAS of Ukraine Award «For Scientific Achievements».

On the eve of the 75th anniversary of the birth of L.M. Lobanov the Editorial Board of the Journal made an interview with the jubilee concerning the directions of his activity.

Prof. Lobanov, many scientists and experts in Ukraine and abroad are familiar with your publications on the topic of creating the cost-effective welded structures, testing their quality and improvement of their reliability. What are the roots of Your interest towards this direction?

Creation of the cost-effective, reliable and long-life welded structures, operating on the ground and under water at normal, high and low temperatures, under different extreme operating conditions is an essential scientific and technical challenge. A great contribution to its solution has been brought by the scientists and specialists of the E.O. Paton Electric Welding Institute. By possessing an extensive knowledge and extraordinary engineering insight, Evgeny Paton, the founder of our Institute, defined the main directions of works associated with the creation of reliable and cost-effective welded structures. They envisage an integrated solution of research, materials science, and engineering tasks. This approach gained a wide development due to activity of his pupils and followers. The R&D works, carried out at the PWI, provided an opportunity of manufacturing the rational welded structures at a high level of automation and mechanization of welding works. Moreover, the basic volumes of welding works are transferred to the plant conditions, providing a significant increase in efficiency of welding processes and improvement of quality of welded joints.

What are the relevant problems to be solved in the related field today?

At the present time the complex of the new investigations is carried out for evaluation of static and cyclic strength of welded joints taking into account their mechanical heterogeneity and presence of crack-like defects, resistance of welded joints to brittle and laminated fractures, development of scientific approaches to providing reliability and longevity of welded structures in implementation of requirements to reduction of their metal consumption, creation of technologies of hardening treatment of welded joints, application of mathematical methods for investigation of thermal deformation processes in welding, wide application of non-destructive testing and technical diagnostics of welded joints and structures. The new types of highly-efficient welded structures, including metal structures, bridge spans, heavy-loaded structures of high-strength steels for mining equipment and railway transport are created.

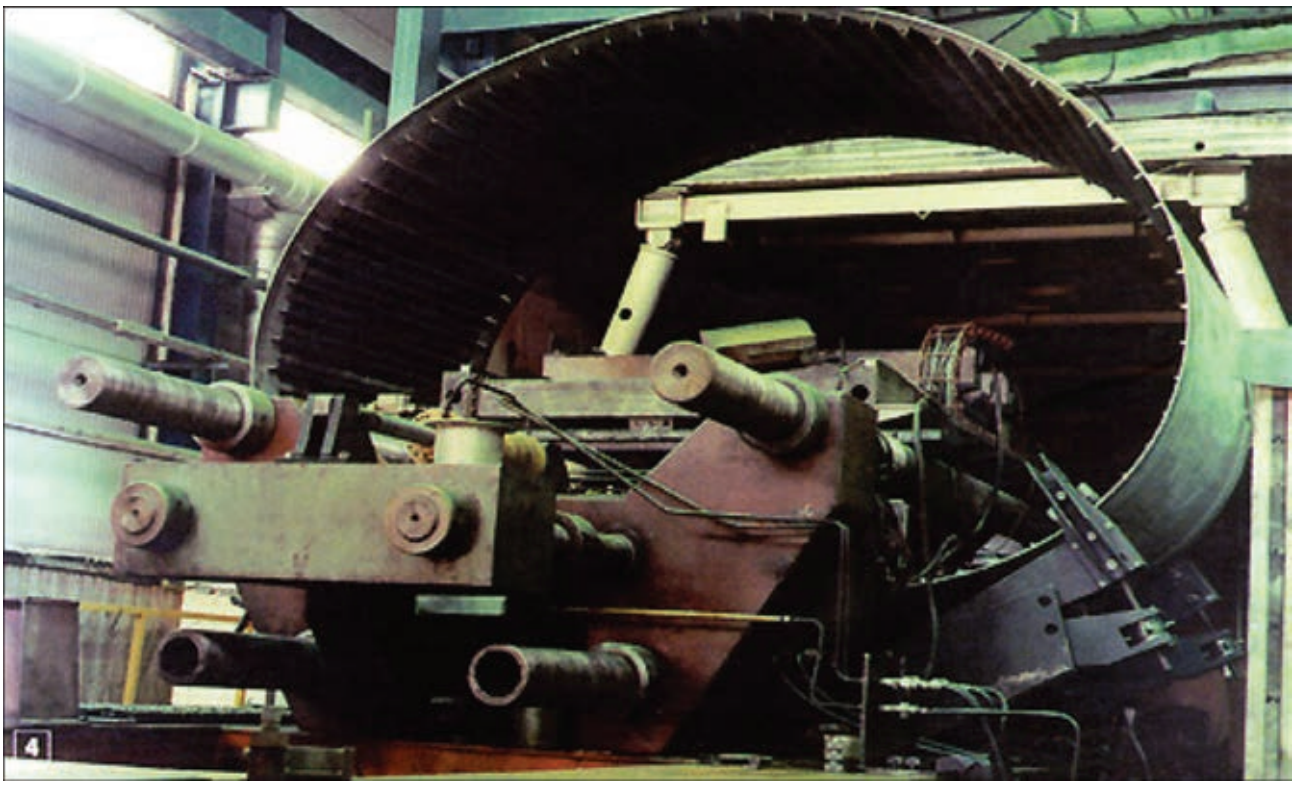
What are the practical examples of realization of the PWI developments in the field of welded structures in the recent years?

The construction of the National Sports Complex «Olimpijsky» in Kiev before the European Football Championship EURO-2012 should be noted. A team of the PWI developed and implemented the technologies of welding the load-carrying metal structures of this unique complex. The scientific and technological support of assembly and welding works was carried out in the plant conditions as well as directly at the construction site. The similar works were carried out during the construction of the International Exhibition Centre at the Brovary highway in Kiev.

The new steels S390–S690 were introduced into production of welded structures and with their application a number of unique engineering constructions was created, among which the oil storage tanks of 50,000 and 75,000 tons volume, spans of the Podolsky bridge and the Chabansky bridge in Kiev. The personnel of the PWI took an active part in the construction of the Darnitsky rail-road bridge in Kiev and was participating in the construction of the Zaporozhsky bridge. The scientific and technical support of assembly and welding works was carried out in erection of aluminium alloy metal structures of the roof of terminal «D» at the Borispol airport. A large experience of research and development works of the PWI in the fields of design and manufacture of different types of constructions, determination of their technical condition and reconstruction is summarized in the three-volume edition «Welded Constructions».

Prof. Lobanov, in your publications the term «deformation-free welding of structures» is frequently used. Could you explain the essence of such approach in production of structures?

Thanks to our developments a new scientific and technical direction, i.e. deformation-free welding of structures, was formed, which is based on creation of the preliminary stress-strain states before welding, optimized with respect to the welding stresses and deformations. For all types of welded joints the methods for determination of optimal parameters of preliminary stress-strain states were developed, which allow eliminating the residual welding deformations. This approach includes also the use of



assembly-welding units that combine distorting systems, equipment for mechanical treatment of welded edges under the conditions of preset loading and specialized welding equipment.

Could you please give some examples of its use?

It was realized at the enterprises of rocket and aerospace industry in manufacture of thin-walled structures of light alloys, to which high requirements as to the accuracy of geometric dimensions and quality of joints are specified. The unique installations were delivered to the enterprises of P.R. China under the contracts. At the moment the contract with the Design Bureau «Yuzhnoe» was concluded for the development of technology of deformation-free welding of stringer panels and, in future, of stringer shells of high-strength aluminum alloy.

What new methods of non-destructive testing would you prefer?

A significant contribution to the creation of systems for diagnostics of products of space and aircraft technology was made. A diagnostic method of electronic shearography, which is based on application of laser equipment and computer processing of optical information, was developed. Its essential advantage is contact-free measurement and the ability to perform a real-time non-destructive quality control of objects of both metal as well as composite materials. The developed technology for diagnostics and shearography equipment were implemented at the Design Bureau «Yuzhnoe». The investigations at the specimens of aircraft lining, carried out on the order of the State Enterprise «Antonov», showed that the method of electron shearography reveals corrosive damages of the elements of fuselage and wing of the aircraft without disassembly of lining and sealant.

On the basis of application of the method of electronic speckle-interferometry the technology and portable device for determination of residual stresses in welded joints of structures of new technology were created. The competition, carried out by the International Institute of Welding, confirmed that the method and equipment for its implementation developed at the PWI provide a valid evaluation of local peculiarities of residual stressed state of welded joints. This methodology and equipment are effectively used in the laboratory practice of the PWI and were delivered under the contracts to different industrial and research organizations of far abroad.

Prof. Lobanov, it is known that in the recent decades You are devoting many efforts and energy to the problem of residual life of continuously operating structures and constructions. How is the work in this direction organized in Ukraine?

In many countries the tendency of expiration of standard operation terms of a great number of structures, constructions and engineering systems is observed. This problem became of a particular importance in Ukraine. Due to the difficult economic conditions the majority of subjects of economic activity almost stopped renovation of main resources. In this regard, the issues of safe operation of the critical objects of industry, power engineering, transport, construction become every year more and more relevant. Those tasks are important, which are related to the control of operational reliability and longevity of such objects by determination of their technical condition and residual life, establishment of scientifically based service terms and regulations.

To the solution of these problems the target integrated program «Problems of Life and Safe Operation of Structures, Constructions and Machines» of the NAS of Ukraine is devoted, which has been carried out since 2004. The scientific supervisor of the Program is Prof. Boris E. Paton. The aim of the Program is the development of methodological bases for prediction of residual life, development of methods, techniques and technologies for evaluation of technical condition and life extension of technogeneous and environmentally dangerous objects.

The projects of the Program are aimed at the implementation of such important tasks as development of methods and means for non-destructive quality control and technical diagnostics of structures; creation of systems for continuous monitoring of critical objects of long-term operation using the modern information technologies; development of methods for prediction of residual life of structures with damages and technologies for restoration of their operability; creation of effective methods, mechanical means and technologies for evaluation and extension of life of equipment for heat and nuclear power engineering, chemical and petroleum industry, oil and gas pipelines, aerospace engineering, as well as bridges, building and transport constructions; preparation of standard documents, scientific and technical handbooks and manuals on evaluation and life extension of objects of long-term operation.

Are there any positive results of performance of works by the program «Resource»?

In the process of implementation of projects of the Program the significant scientific, technical and practical results were obtained. Thus, the acoustic emission systems were introduced for continuous diagnostics of equipment components at the Odessa Port Plant and the district heating plant «Kievenergo», the equipment for contact-free measurement of surfaces wear of railroad rails was created, the methodology of low-frequency ultrasonic testing of fractures at the hard-to-reach pipeline sections was developed, the technology and equipment for the formation of reinforcing structures were developed using a metal polymer wire coupling for repair of local defects of oil and gas pipelines without stopping the products transportation, the unique industrial objects and spans of railroad bridges were restored, the modern standards and standard documents for engineering practice were issued and many other.

The main results of works by each project of the Program are summarized in the final collections of papers, which are published by the Institute every three years. The specialists regard these collections as the encyclopedia on the problems of life. They make an important contribution to the formation of scientific and technical aspects of engineering culture in our country and provide the new instruments in solving the problems of resource of safe service of structures and equipment.

Thank you, Prof. Lobanov, for Your interesting and thorough coverage of the problems related to the creation of modern welded structures. We wish You a strong health and new achievements for the benefit of Ukraine.

Editorial Board of «The Paton Welding Journal»