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Introductory article

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Contribution of Bulgarian Scientists to Tribology Paradigm Development

The discussion on this topic requires a preliminary comment on facts reflecting the development of **Tribology** phenomenon. It was first announced as a term and a notion in a Britain's governmental report published on 9 March 1966. This date is considered to be Tribology birthday.

The beginning of the applied scientific activities in the field of Tribology in Bulgaria was put by the transformation of the Contact Mechanics Laboratory with the Department of Mechanics at the Technical University of Sofia into Tribology Laboratory on 1 December 1974. It was an initiative of Prof. Niagol Manolov and the team of his fellows and postgraduate students.

In 1984 the laboratory developed into Problematic Research Laboratory in Tribology (PRL) authorized that to be Coordinating Center in Tribology by an act of the Ministry of Education and the State Committee of Science and Technological Progress. In 1989 Bulgaria became a member-country of the International Council in Tribology with a seat in London. Two years later, according to an order of the Ministry of Education and the State Committee of Science and Technological Progress a team under the leadership of Prof. Manolov wrote ***Concept of Development of Tribology in Bulgaria until 2000*** that was accepted by a special technological and economic commission in 1987.

On 2 April 1993 the ***Society of Tribologists in Bulgaria*** (STB) was established as a public non-governmental organization registered according to the Law of Individuals and Families. Its founder and the first President was Prof. Manolov and Prof. Alexandrov became its scientific secretary. At the same time Prof. Manolov was elected Vice-President of International Council and Prof. Alexandrov and Assoc. Prof. Assenova were elected corresponding members.

Another event of great significance was the foundation of the ***Balkan Tribological Association*** in October 1883. The association involved Bulgaria, Greece, Macedonia, Rumania, Turkey and Yugoslavia. Under the aegis of the Balkan Association four Balkan Tribological Conferences were held (in Bulgaria in 1993, in Greece in 1996, in Rumania in 1999, in Turkey in 2002). It should be outlined that the initiative to found this association had been given by the Society of Tribologists in Bulgaria and by Prof. Manolov personally.

The pilot issue of the *Journal of the Balkan Tribological Association* appeared in 1994 and since then it has been published regularly. The unanamimous decision of the Balkan countries to place the editor's office of the journal in Bulgaria is a remarkable suc-

cess for the country. The editor-in-chief is Prof. Slavi Ivanov from the Bulgarian Academy of Sciences (BAS).
Meanwhile, following the example of a number of countries, Tribology has been included in the nomenclature of the scientific specialties in Bulgaria under the code of 01.02.02 (to Applied Mechanics).
The institutional development of Tribology in Bulgaria traced chronologically above as well as the public recognition won by the country in that field have been reached thanks to the works and the achievements of the Bulgarian scientists. At first sight their number is not great but it is enough to present papers at the scientific and technology sessions organized by the Society of Tribologists in Bulgaria in collaboration with the Scientific and Technical Union of Mechanical Engineering every year since 1994. In fact, is that number too great? The answer should be negative because a lot of researchers in almost all scientific fields including the humanities have been developing tribological problems without being aware of it. The reason is that they do not know the ***paradigm of Tribology***.
The notions of the subject of Tribology as a scientific phenomenon in the second half of the 20th century has been developing continuously. As for Bulgaria, Prof. Niagol Manolov with his books has been playing undoubtedly the leading part in creating the cognitive paradigm of Tribology.
As it has already been mentioned, Tribology is a young interdisciplinary science. However, the idea based on the literal translation of the notion of Tribology as a science of friction still exists. Both in Bulgaria and other countries the notion of Tribology has passed a long way of evolution to reach the idea acting at the moment: "Tribology is a science of contact and contact interaction between bodies without limiting their nature and functions"[5]. Thus Tribology has received the status of an independent fundamental interdisciplinary science where the contact differs from the contact elements in its structure and functions and has a status of a third element. It has a central part in the integral behavior of the system[5]. "The interaction of alternatives by the dynamically changing contact between them is the mechanism keeping the unity and stability on the **whole** with its functioning" [3].

The model that has been built by Prof. Manolov in his books is "pluralistic". According to him, three independent elements forming "body-contact-antibody" **triad** are functioning in each **entity**.

Trialism is defined in that aspect and according to it "each **whole** on ontological level should consist not of two but of three base elements: two alternative and one contact between them" [5]. The third body serves as a universal link of the rest and is expressed by metabolism and exchange of energy and information among them [1].

All said above shows the leading part of Prof. N. Manolov in formulating the theoretical and methodological problems of Tribology. Having founded a school in Tribology in Bulgaria with more than 10 doctors and dozens of students and followers, he has dedicated himself to public activities, especially the establishment of Interdisciplinary Public Academy (INPA), for the last ten years.
Another Bulgarian scientist dedicated his research to Tribology and especially to Tribomechanics for the last 20 years is Prof. Vassil Alexandrov from the Department of Technical Mechanics with the University of Architecture, Civil Engineering and Geodesy in Sofia. Having graduated from the Tribology School at the Imperial College in

London, he has gathered a small group of young Bulgarian scientists around himself, mostly from the Department of mechanics at the Todor Kableshkov Higher School of Transport in Sofia.
Without having any special claims for the development of Tribology paradigm, he has proved the triad formula in practice using the basic structure model of a sliding bearing with his research in the field of thermal elastic hydrodynamic friction. The research made recently has a complex character and examines the dynamic properties of contact as a third body, at that taking into consideration its reologic properties [12]. The results obtained have not only theoretical but also applied-science significance.
Besides its scientific activities, Prof. Alexandrov has taken part in institutionalization of Tribology in Bulgaria. He, in collaboration with Prof. Manolov, contributed to the establishment both of the Bulgarian and Balkan Tribology associations.
The activities of scientists from the University of Chemical Technology and Metallurgy in Sofia in the field of Tribochemistry should be also mentioned. The achievements of the fellows in Tribology Laboratory at the Technical University of Sofia, particularly in Triboengineering have not to be neglected as well but it is impossible to involve the scientific activities in all aspects of Tribology within the frame of one article.
At last, let us discuss the following question: is there a crossing point between the conception of Mechanics and that of Tribology (Tribomechanics)? This question is not put occasionally as there are opinions that Tribology is in fact Complex mechanics. Not depreciating the other aspects as Tribochemistry and Tribophysics, Tribomechanics really has the leading part. It should be outlined that despite the perfection of the scientific model of mechanics its approach is one-sided as of any formal science no matter it is fundamental. Tribology does not study the behavior of all bodies in time and space but only of the third body that forms the contact of bodies. "On the other hand it studies it in a multi-sided way, complex, in all possible sections: mechanical, physical, osimic, etc." [1].
It can be finished in the words of Peter Joist, President of The International Council of Tribology, said in his address to the First Balkan Conference in Tribology Balkantrib'93 held in Sofia on 1-3 October 1993: "I was impressed when I read the article of Prof. Manolov "Tribology and the World We Live in". The broad-minded view expressed in it can only help to put Tribology in the position required by the contemporary industrial century…"

* In historical aspect, Prof. G. Danov was the ancestor of research in the field of friction in Bulgaria.

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