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**INTERNATIONAL SCHOOL OF TRIBOLOGY**

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**Abstract**

*Despite of the innovative interdisciplinary intensity of tribology and of the evident technological and economical actuality, The problem with the training of specialists in this field is far behind. The idea for international training of tribologists existed potentially in the functional space of the Balkan Tribological Association already in the day of its founding in Sofia 1993.*

*The paper offers a concrete project for founding such international institution (a school), which should function independently in each country with legal international program. The training in the school should be completed by international diploma, valid in the Region, Europe and worldwide. In each country the school should be headed by director on the territory of a certain higher educational school with the biggest experience in the field of research and education in tribology. In the beginning the school should start with one-year training of bachelors from different domains and graduate with a diploma for Master-tribologist.*

**Keywords:** *education, tribologists, international school*

**1. INTRODUCTION**

If we observe tribology from the point of view of the problem situation of humanity, it is clear that the subject of tribology should be enlarged and given a new meaning as a modern interdisciplinary science. In fact, if we examine any technical, social or natural science with its form and contents, it is represented in singular and is expressed by the number one. For example, one tribotester, one Earth, humanity, etc. Speaking about them in singular, we have in view their form expressed externally through the name but everybody knows that inside this “one” are hidden multiple elements as a contents. For example, for the tribotester – a motor, a reduction gear, a slider, etc, for the Earth – continents, oceans, rivers, atmosphere, woods; for humanity – men, women,

communities, families, nations, states. So we come to the paradox situation that everyone is many, regardless of its place in nature, techniques and society. In our case the one of each wholeness is identified by its form, and the many – by its content. Here comes the question: Is there a third thing between one and many or they are separated by insurmountable abyss (or demarcation lines). The answer of tribology is that this third thing exists, and that are the contacts between the elements of the many, which are unified in contact webs. Further the contact webs realize the unity and stability of the many as wholeness.

As a substance, structure and behavior, the contact webs differentiate, unify and realize the unity of the variety of each wholeness in nature, society and techniques. In general, we find out that every wholeness, despite its nature

(material, spiritual or cultural), has a content as multitude, connecting texture as contact web, and form as unity. So, in order to go from the form to the content and vice-versa we have to run over the contact web, which is central for their infrastructure.

Let look from the point of view of science as a wholeness. It is seen that the multitude of sciences are expressed as one thing through the unified paradigm of science by the contact web of interdisciplinary sciences. Hence, the center of science should not be searched in the different sciences or in their form, but in the contact web of the interdisciplinary sciences, which realizes them. The contact web is the combination of all kinds of contacts: external, internal, proper; material, spiritual, cultural; creative, destructive, neutral. The interdisciplinary science of contacts in their fundamental dimension is tribology. Otherwise, overall tribology as a science of contacts is a fundamental interdisciplinary science of or time.

## 2. DO WE NEED AN INTERNATIONAL SCHOOL OF TRIBOLOGY, AND, IF YES, WHY?

The answer to this question should be affirmative, the argumentation is, however, not so simple.

1. The time we live in is the third millennium, but the consciousness, the sciences and the logic of our perception, rationalization and argumentation of processes and events from the being continue to be from the past, from the time of Aristotle, with the triumph of the bipolar logic through the law of the excluded third. If the formula of the bipolar logic is that everything consists of  $A$  and  $not - A$ , then the paradigm of tribology requires between them to be placed a third thing according to the formula: Each one is three – two alternatives  $A$  and  $B$  plus one contact  $C$  between them. Besides, the fundamental functions and role of the whole are concentrated in  $C$  (contacts and contact webs). This is the reason why tribology takes a marginal place in the engineering education at present: it is contra-indicated for the dominating paradigm of the formal science in the universities. According to this paradigm the education is a mechanical sum of professionally differentiated science disciplines, each of them represented by structured sections related hierarchically in vertical direction, but not in

horizontal direction. In this situation the student passing from one discipline to another, from one department to another, endures a distress each time by the forced adaptation to the formal-science requirements for each department and teacher.

2. The crisis, in front of which stays humanity, is a crisis not only for the intellectuals, but also for all citizens, according to the sentence “the world is no more that what it was”. The phenomena of corruption, mafia movements, terrorism, prostitution, poverty, natural and ecological disasters, epidemic, etc. are taken into consideration. The question: “What is missing to mankind in order to assess correctly this world and overcome the crisis?” has still no universal answer.

Tribology is the first interdisciplinary science, which through its “illogical” third (contact) object gives such answer, namely, that the universal crisis is a crisis of human consciousness related to the bipolar logic and is therefore ontological crisis; that the crisis is not due to the change of the world, but to the delay of our consciousness and logic, which is a particular disease called by us “**contact insufficiency of human consciousness**”.

3. Humanity stays in front of about 30 thousand global problems at this stage, which are complex as nature and presuppose interdisciplinary approach to be considered. The paradox situation is expressed through the formula “Unity in variety”. What is the way to develop a scientific approach, which should be on the level of the problems we stay in front of? How to integrate the fragmentary formal-science knowledge in order to be adequate to the continuously rising new problem situations? The answer of tribology is convincing and punctual also in this case. This can be done if only we place contacts and contact webs between variety and unity, which to represent the real substances, structures and mechanisms transforming cvariety in unity and vice-versa. That’s why the requested global (integral) approach corresponding to the global (integral) character of humanity problems should be called **contact** approach.

4. Well-known is the view that the world is not only like we see it but is also dependent on the observer and the place of the observation. What new offers tribology concerning the choice of observation point? The answer is that the observation point should be displaced from the space of the alternatives of the whole into the

contact zone between them and more precisely in the parts of contact, which are neutral, called by us “contact zero”. In this way tribology grounds for the first time a privileged (consensus) view point in the functional space of each whole, because this point is neutral as regards the interests, tendencies and longings of the elements of the whole and of the related people.

The initiative for founding an international school of tribology is due to the Balkan Tribological Association (BTA), because it was the area where the modern paradigm of tribology as interdisciplinary science was developed completely and with anticipation. The school should be international, because the national university structures do not accept the modern tribological paradigm. The unique mechanism to implant this paradigm in the hierarchic structures is through the international civil associations and foundations. If this idea is adopted by the present forum of BALKANTRIB'2005, it must be operatively agreed and adopted further on European and world level according to the hierarchy of the tribological associations and councils.

### **3. ON THE METHOD OF WORKING OF THE SCHOOL**

In correspondence with the paradigm of tribology, the center of the method should be displaced from the area of the different disciplines into the frontier zones between them, which we have denoted as contacts and contact zones. The education system should also displace its center from the teacher and student as alternatives, into the functional space between them.

In the contact cross-section, the methods of the university education can be characterized as totalitarian, anarchistic and interdisciplinary.

#### ***The spirit of totalitarianism in education***

This spirit is expressed in a vertically structured and functionally centralized management system. The top of the system is the Ministry of education and science, lower are the rectors and academic councils, deans and faculty councils, department directors and department councils, lecturers, students. In spite of the principle of autonomy of the universities, this system goes on working, especially in the frames of the different universities. An example is the centralized distribution of the limit of

students' admittance and the distress at the end of the semester and during the exams.

Characteristic for this kind educational system is that the managing informational flow is one-way – from top down. The contrary flow is reactive (defensive), i. e. the down levels are forced to defend, reporting false information about the results of the completion of the management orders. As an idealized position this style considers the lowest element in the system, in this case the student, as a mechanical element, which should be moved in some direction dependent on the impact of the management signal. In the basis of this model is the scientism as a culture. According to determinism in natural sciences, it assumes the absolute character of the causal-consequence relations in society and from there on, in the system of education.

The application of the totalitarian management style as per the principle “split and control” leads to the creation of many universities, faculties, specialities, departments and disciplines. This trend leads to isolation and “cocooning” of all students and teachers. The system actually degrades in a disperse mechanical system. Motivation for the students and teachers is a fear not to violate the requirements coming from the top, and the result is death of creativity in the system.

An educational system is totalitarian, when it relies exclusively on external force from the top. Here the elements try to outwit each other, the ones with their “troubles”, the other ones with their “endeavor” up to full corruption and degradation of the relations between them.

If we consider the functional cell of any bipolar educational system “teacher-student”, we'll see that in the center of this cell is placed the teacher, with his “higher” discipline qualification, and the student is in the margin. The teacher explains in a logic way, along with a defined program, at a fixed place and time, in front of students whose presence is obligatory an exactly defined methodological unit. The student should only be present, remember and reproduce during the exam that what the lecturer had told. Like the director of department, the dean, the rector do not like “peculiar” (naughty) lecturers, not following the uniquely right line of the top, so does the lecturer “pursue” the student in his desire to turn aside from the right way of the presented lectures during the exam. (The truth is unique, so is the way toward it). The student is educated, but not taught. Follows the

question: does another functional structure for this cell exist? Pursuing the bipolar logic, the adversaries of the totalitarian system of an alternative structure “student-teacher”, by that in the center of the cell is placed the student, and in the periphery – the teacher. This system can obviously not improve the quality of education and a destructive spirit will appear – the spirit of anarchism.

#### ***The spirit of anarchism in education***

The formula of this system is: “all truth is relative and the ways to it – subjective”. The student can obtain knowledge, but do not get education. Both variants do not work toward improvement of the quality of the educational systems. Why? The answer is simple – because the basic cell of the educational system is not stable, and hence, it degrades inevitably in time. The instability is caused by the fact that it is located on two points of support, i.e. the cell “teacher-student” is unsustainable, because it is ontologically not completed. The missing part is the contact between them, which separates, joints and realizes the two alternatives. The contact is the soul of the educational process, which transforms the explanation of the teacher into a comprehension by the student. The system “teacher-contact-student” is stable – it has three points of support and allows sustainable development toward higher quality, effectiveness and prosperity. In the center of it stay the relations between teachers and students. The extreme left system of totalitarianism is obtained if the functional center of the system leaves the zone of contact този начин крайно лявата система на and goes to that of the teacher, and the extreme right – to the zone of students.

#### ***The spirit of interdisciplinarity in education***

The interdisciplinary approach assumes improvement of any cell of the educational system, so that its functional center does not leave the contact zone between teachers and students. This can be reached by a new thinking, when the attention of government and people is directed towards the relations between them (material, spiritual and technological), which should be brought up and enriched. It should be accepted that every person does not react directly to an external influence, but to the signals from the contact (through his personal systems of values), which separates him from the external signal. The control of the functional contact between teachers and students is not

mere science, it is also art and technology. Due to the acting system of education, and qualification, the lecturers are not acquainted with this science, nor with the art and methodology of training. Let remember the words of two great European thinkers, Newton, who says “God is not in things, nut between them”; and Goethe: “Between the extremities is not the truth, but the problem”. Finally it could be stated that by the interdisciplinary education the students are trained and gain knowledge in order to be educated, i. e. to learn solving the problems.

#### ***Why does interdisciplinarity require the origin of coordinates of the educational system to be placed in the contact zone?***

This is because visibility from that position is neutral, hence, reliable. It means in fact that teacher and student should be assessed as per the problems they have solved by themselves, as per their creative achievements, like persons graduated from their university and their country.

The purpose of the International School of Tribology is to displace the functional center of each educational cell to the right, towards the students, by means of improvement of quality and content of the interdisciplinary education. This displacement should not bring the center out of the contact zone, but bring it nearer to the optimum functional center (the contact zero) of the whole system. Our aim will be gained through a system of planned tasks in time, place and action, with the necessary material, personnel and financial resources.

We would like to summarize the ideal image of the International School of Tribology:

- Availability of consensus doctrine for the International School of Tribology having a great attractive force in the countries and abroad;
- Availability of rich material basis and qualified scientific-lecturer’s personnel in the whole spectrum of tribological problems;
- Own market tribological niche realized through the functional contact web of national schools in universities, institutes, academies, companies (customers and manufacturers of tribological products, materials and services);
- Important theoretical and technological achievements of the School, approved in local, regional and world level;
- Rich informational and publishing activity through newspapers, magazines, manuals,

monographs, internet, broadcasting, sessions, conferences, congresses, etc.

- Big sponsors in the country and abroad;
- Participation in competitions with projects in national and international programs;
- Own intellectual market, technological centers and shops for products, technologies and services in tribology;
- Building of vertical and horizontal structure of the School in the countries and abroad;
- Own production of tribologists on different levels: high-school, bachelor, master, doctor.

#### **4. WHAT SHOULD BE THE BEGINNING?**

The building of the International School of Tribology is a time-consuming process. The beginning was made with the establishment of BTA and BALKANTRIB as integral tribological formations, which should provide not only scientific and technological growth, but also human resources as specialists in tribology. The task to build the International school became a priority for our region, as the paradigm of tribology proved significant anticipating progress in this part of Europe concerning its interdisciplinarity.

Presupposition for building such school is the experience in our countries and universities in the field of education on different levels, the advancement in publishing and distribution of manuals, handbooks and other instructive materials, the building of edifying and research laboratories, the organization of workshops and practicum, classes in the free faculties, teaching of graduate and postgraduate students, organization of seminars and discussions with educational topics, etc.

In particular for Bulgaria, attention must be drawn to the experience of the non-governmental civil organizations, namely the Society of the Bulgarian Tribologists and the Interdisciplinary Civil Academy. In the statute of these associations are legally included arrangements regarding training and education in the field of tribology and interdisciplinarity.

Another specific item is the organizing of permanent inter-university seminar on tribology and interdisciplinarity to the Tribology Center at the Technical University - Sofia. The Tribology Center and the Seminar, as per their statutes, provide the interuniversity policy and methodology in the domain of education and engineering training of tribologists.

There are also many examples for other interdisciplinary directions in the area of the international education and training. Mention can here be made of the experience of the International Institute of Welding. They have built a web of international schools and issues diplomas to international engineers of welding. One of these schools works at the Technical University - Sofia.

Having in view a. m. experience, we would like to present following operational proposals:

1. Establishment OF THE international School of Tribology at the forum of BALKANTRIB'05 with election of a Managing Board of the School with a director and members from the different countries, also outside the Balkan region. The task of the Managing Board of the School as a branch of BTA is to develop and reach agreement of the statute, regulations, schedules and programs for training in the School.
2. According to the statute of the School, to start the building of national schools reflecting the specifics of each country. The directors of the national schools should be members of the managing boards of the corresponding tribological societies. Regulations, schedules, school programs and certificates should be agreed with the Managing Board of the International School, the diploma being issued by the corresponding national tribological society as legal person.
3. Education to be proceeded in the existing universities using the line of postgraduate specialization for the period of one year according to a direct contract between the school of tribology and the university.
4. One possible source for funding of the preparation of the International School of Tribology is the participation in international projects at the European Programs in the field of education and communications.
5. A first functional forum of the International School of Tribology could be the preparation and training of international engineers in tribology with a duration of 1 year with a schedule of 18 hours weekly teaching in three days by discontinuing work for engineers – bachelors or masters, which apply for a qualification and diploma as international engineers in tribology.

## 5. CONCLUSIONS

Tribology is an interdisciplinary science in the sense that its achievements are related to the being in special, spiritual and cultural context. This is however not complete. It is important to emphasize that tribology is a fundamental interdisciplinary science, because by means of its object – the contact and the contact webs – are built the variety and wealth of the world we live in, especially for our case – in the field of education and training through the contact approach.

In the function of modern paradigm (view and model of the globalizing world of the third millennium), tribology is illogic as methodology and behavior used for educational and scientific doctrines of the industrial society. Realizing all this, the Balkan Tribological Association (BTA should provide the necessary organizational and managing structures in order to introduce in practice tribology as thinking, order and behavior. This is extremely important in the education and training of future tribologists.

The International School of Tribology at BTA should get ahead in the development, standardization and application in the educational-research activity this style and conduct in the future tribologists. The School can solve its tasks only with the active support and participation of the national tribological societies and groups in BTA. Their integration could be assisted by a permanent section in the Journal of the BTA with the title “International School of Tribology”.

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