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В статье рассказывается о создании Международной Федерации по Теории Механизмов и Машин (ИФТоММ), а также о жизнедеятельности Ивана Ивановича Артоболевского, известного советского ученого в области теории механизмов и машин (ТММ), академика АН СССР, первого Президента ИФТоММа, автора многочисленных научных работ по конструированию механизмов. Он внес огромный вклад в современную науку о машинах и механизмах как ученый, инженер и организатор.

Ключевые слова: ТММ, история ИФТоММа, история науки о машинах и механизмах (ММС), конструирование механизмов, персоналии.

IFTToMM First President Ivan Ivanovich Artobolevski

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The paper describes the foundation and development of the International Federation for the Promotion of Mechanism and Machine Science (IFTToMM) and the lifetime activity of Ivan Ivanovich Artobolevski, the Soviet famous scientist in area of Theory of Mechanisms and Machines (TMM), academician of the USSR Academy of Sciences, the first IFTToMM President, author of milestone scientific works on Mechanism Design. He contributed greatly to modern Mechanism and Machine Science (MMS) through his work as researcher, engineer and organizer.

Keywords: TMM, History of IFTToMM, History of MMS, Mechanism Design, Personalities.

IFTToMM, the International Federation for the Promotion of Mechanism and Machine Science (up to 2000 named as the International Federation for the Theory of Mechanisms and Machines) was founded by

people, who believed that collaboration among engineers and scientists from various countries would improve the effectiveness of the Science for enhancement of life and society. Memory of their names is aimed at keeping a track of the IFToMM evolution and even its future trends. The third generation of IFToMMists is today in action as people, who are interested and active in MMS with a heritage of IFToMM founders. Their awareness of IFToMM significance gives identity to the community with future evolution [1].

IFToMM was founded in Zakopane, Poland, on September 29, 1969, during the Second World Congress on Theory of Mechanisms and Machines (TMM) (Fig. 1). Four years before, in 1965, September, the First International Congress on TMM took place in Bulgaria near Varna. There, at final session, on behalf of Bulgarian scientists Professor Mikhail S. Konstantinov proposed to create an International Coordinating Committee on TMM to direct activity of national conferences in the mentioned area and to provide conditions for a foundation of a Federation on TMM in future. To name the new organization an abbreviated form under the first letters of the English words was used — IFToMM [2]. Thus, in frames of the Second Congress on TMM a Constituent General Assembly of IFToMM took place, where the Chairman, Prof. Jan Oderfeld from Poland, officially declared the creation of a new Federation and the Congress series were immediately recognized as the IFToMM World Congress.



Fig. 1. 1969, IFToMM Congress (IFToMM Archive)

From the very beginning the main promoters of the new Federation were Academician Ivan Ivanovich Artobolevski (USSR) and Prof. Erskine F.R. Crossley (USA), whose principal aim was to

overpass the obstacles of the time of the Cold War, to develop international collaboration in TMM science for the benefit of the world society. The great positive role was played by the scientist from Bulgaria Professor Mikail S. Konstantinov, who became the first Secretary-General of IFToMM. In his memories Artobolevski wrote that he had a strong friendship with both — Prof. Crossley and Prof. Konstantinov, who were all together one team.

Ivan Ivanovich Artobolevski dedicated a lot of his efforts and energy to the integrity of specialists from different countries as he understood perfectly well the importance of international contacts and exchanges for the Soviet and the world science [2, 3]. When the Federation was founded, in 1969, Artobolevski was unanimously elected the first IFToMM President. He held the post for two periods (8 years) and then became the Past-President up to his final days. Besides, he was the first Chairman of National Committee of the Soviet Union on TMM.



Fig. 2. Foundation of IFToMM (IFToMM Archive)

The Federation started as a family of TMM scientists (Fig. 2) among whom we may identify the IFToMM founding fathers, who signed or contributed in the foundation act with the initial of 13 Member Organizations, in the persons: Academician Ivan Ivanovich Artobolevski (USSR), Prof. Erskine F.R. Crossley (USA), Prof. Mikail S. Konstantinov (Bulgaria), Dr. Werner Thomas (GFR), Prof. B.M. Belgaumkar (India), Prof. Kenneth H. Hunt (Australia), Prof. J. Oderfeld (Poland), Prof. Jack Phillips (Australia), Prof. George Rusanov (Bulgaria), Prof. Wolfgang Rössner (GDR), Prof. Zèno Terplàn (Hungary), Prof.

Jammi S. Rao (India), Prof. Giovanni Bianchi (Italy), Prof. Adam Morecki (Poland), Nicolae I. Manolescu (Rumania), Leonard Maunder (UK), Douglas Muster (USA), Ilic Branisky (Yugoslavia). The Foundation Act (document) is kept now in IFToMM Archive (Fig. 3).

We, the undersigned chief delegates at the Inaugural Assembly of the International Federation for the Theory of Machines and Mechanisms (IFTOMM) here at Zakopane Poland on 27th September 1969, declare that we have founded the above-mentioned Federation and that we have adopted its Constitution which is attached hereto and decided to the following categories (see Article 8.4 of the Constitution).

Territory	Chief delegate	Proposed Category	Signature
Australia	JACK PHILLIPS	I	<i>Jack Phillips</i>
Bulgaria	George Antonov	II	<i>George Antonov</i>
German Democratic Republic	Hilfing Rössner	III	<i>Hilfing Rössner</i>
German Federal Republic	Klaus Thoma	IV	<i>Klaus Thoma</i>
Hungary	László Farkas	V	<i>László Farkas</i>
India	J. S. RAO	VI	<i>J. S. Rao</i>
Italy	Giovanni Bianchi	VII	<i>Giovanni Bianchi</i>
Poland	Adam Morecki	VIII	<i>Adam Morecki</i>
Rumania	Nicolae I. Manolescu	IX	<i>Nicolae I. Manolescu</i>
United Kingdom	Leonard Maunder	X	<i>Leonard Maunder</i>
U.S.A.	Douglas Muster	XI	<i>Douglas Muster</i>
U.S.S.R.	Ilic Branisky	XII	<i>Ilic Branisky</i>
Yugoslavia	Ilic Branisky	XIII	<i>Ilic Branisky</i>

Fig. 3. The Foundation Act (IFToMM Archive)

The foundation of IFToMM was the result of an intense activity for stimulating and promoting international collaboration, more than never in the past. The modernity and relevance of IFToMM activity can be recognized in the common frame of views and results on TMM, although in many different technical fields. Thus, the role of IFToMM can be still recognized, like stated in its constitution, as instrumental in stimulating enhancements and giving common frames and views for the evolution of MMS both with technical aims and benefits for the Society. Since the beginning, IFToMM Community has been very active in deepening and applying TMM, but even in enlarging TMM areas of interest. The modernity of MMS has augmented TMM with new vision and means but with many new disciplines, whose the most significant can be recognized in: Robotics; Mechatronics; Computational Kinematics; Computer Graphics; Computer Simulation; CAD/CAM for TMM. Thus, the new Science vision of TMM can be recognized in an in-

terest and integration of other aspects/disciplines for the study and design of modern current mechanical systems.

The IFToMM community has grown continually over time and the TMM has evolved to encompass large engineering science, including even new disciplines. This has brought in the year 2000 to an update of the name of IFToMM as the International Federation for the Promotion of Mechanism and Machine Science and a change of the name of TMM to MMS (Mechanism and Machine Science) in order to emphasize the modernity and broader mission of the IFToMM community.

The IFToMM activity has grown in many aspects, as for example concerning the membership (from the beginners 13 to the current 48 members), conference events (beside the MMS World Congress, with many other Conferences and Workshops, even on specific topics, at national and international levels), and Technical Committees working on specific discipline areas.

The IFToMM community evolved in character from that of a family of a few beginners and founders into a scientific worldwide community through the following generations:

- 1950's–79' First generation: founding fathers and their friendly colleagues up to the 4-th IFToMM World Congress in Newcastle-upon-Tyne in 1975, with Professor Maunder as Congress Chair;
- 1980–95 Second Generation: students and people educated by founding fathers and their friendly colleagues; up to the 9th World Congress in Milan in 1995 with Professor Rovetta as Congress Chair;
- 1996-today Third Generation: educated people in the frame of IFToMM and within IFToMM activity with 48 national organizations as IFToMM members. The detailed today information on IFToMM is available on website: <http://www.iftomm.org>.

For more than forty years the IFToMM has grown rapidly through the people who have been involved in its activity [2, 3]. One of them is Ivan Ivanovich Artobolevski, the successful organizer, beginner and founding father, the first IFToMM President. He was one of the first who joined the Coordinating Committee on TMM, participated in

its sessions, worked over the Constitution for the future Federation. Without any exaggeration it is possible to say that the last 12 years of his life Ivan Ivanovich paid unrelenting attention to foundation and strengthening of IFToMM.

To expand the connections and to involve new people Artobolevski invited some representatives of IUTAM (International Union on Theoretical and Applied Mechanics), IFAC (International federation on automatic control), ICM (International Centre on Mechanics), ISO/TC (International Organization for Standardization, Technical Committee) and others, at sessions of IFToMM Executive Council. With enormous energy he promoted a role and value of the Federation and as a result for the period of his presidency the number of IFToMM members has almost doubled.

In IFToMM Executive Council (EC) Artobolevski managed to create a spirit of efficiency and friendship. Possessing a diplomatic talent he always tried to speak logically and with conviction, showing finesse. He had continuously stimulated EC members in friendly collaborative ways and great satisfaction seems to be achieved from both sides. It is not causal that his proposals and decisions were supported by all.

Artobolevski participated in the work of the Third International Congress on TMM and II General Assembly of IFToMM (Dubrovnik, Yugoslavia, 1971) where he was re-elected for the second term. At plenary session he presented a paper «The past, the present and the future of Theory of Machines and Mechanisms», taking an epigraph from the famous scientist-philosopher, John Bernal:

«In a science more than at other institutes of mankind, it is necessary to study the past for understanding of the present and domination over the nature in the future».

It is important that since the beginning, thanks to Artobolevski's chairmanship, the Soviet and Russian scientists actively participated in scientific IFToMM events, and still today many of them are the members of IFToMM Committees and Editorial Boards.

From private memories of I.I. Artobolevski [4]:

«Having founded the International Federation on TMM (IFToMM), I have completed successfully my mission as a scientist and an organizer of science».



Fig. 4. Ivan Ivanovich Artobolevski (1905—1977)

Ivan Ivanovich Artobolevski (Fig. 4) was born on October 9, 1905 in Moscow as a son of a faith teacher [2—4]. Artobolevski's house was always full of scientists, professors, philosophers, and among them was the presence of the famous Russian historian Vasily Osipovich Kluchevsky (1841—1911). The atmospheres of creative work as well as the relationship with well-known natural scientists like Dmitry Nikolayevich Prianishnikov (1865—1846), Sergey Alekseevich Zernov (1871—1945) and Nikolay Mikhailovich Kulagin influenced on the interests of young Ivan towards natural science, machines and technology.

His mother Zinaida Petrovna Artobolevski taught him music and Russian language. Since then, Ivan Artobolevski was interested in music and kept deep understanding of it during all his life.

Young Ivan passed his first examination in 1915 when he went to gymnasium. In 1921, under the influence of his tutor Professor Aleksey Fedorovich Fortunatov (1856—1925), who inculcated in his pupil love for mathematics, Artobolevski went to the faculty of Mechanical Engineering at the Moscow Agricultural Academy and he successfully graduated in 1924.

After the October revolution, in 1918, by reason of the separation of the church from the state and the extinction of the Divinity Department, Artobolevski's father was dismissed from his position and forced to accept a job of a parson in a small parochial church. Consequently the family suffered in poverty. In 1938, his father was sentenced to death and executed by a firing squad on February

14. Still, this tragic fact did not prevent Ivan Ivanovich Artobolevski to follow his career in USSR frames up to the top rank positions.

Professor Nikolay Ivanovich Mertsalov (1866—1948), a well-known scientist in area of Theory of Mechanisms and Machines (TMM), together with Academician Vasily Petrovich Goriachkin, the founder of the new, for that time, «Agricultural mechanics» science, became Artobolevski's first teachers. According to their advice he attended a complete course at Faculty of Physics & Mathematics at Lomonosov Moscow State University (MSU). Having obtained such fundamental knowledge and even being young, Ivan Ivanovich solved a number of complicated problems in the field of flat and space mechanisms of agricultural machines.

Artobolevski was a goal-oriented person, full of optimism and positive energy. He never lowered himself to revilement; all the colleagues noted and admired his remarkable self-control. His friendship with one of the greatest intellectual Anatoly Vasilyevich Lunacharski (1875—1933) had a significant influence on a young Ivan.

The scientist's wife Olga Nikolaevna Artobolevski was a pianist and a singer and promoted his approach to art personalities. She was also one of the authors of IFToMM's hymn.

In 1939 and the Institute for Machine Science (IMASH RAS) was founded with academician Eugeny Alekseevich Chudakov (1890—1953) as the first Director. From the very beginning Ivan Ivanovich Artobolevski worked in the Institute, where he established and headed a laboratory of «Machine Mechanics and Control». Since the beginning of the Second World War all the collaborators of IMASH were evacuated to the deepest rear Kazan (Russia), but the corresponding member of the USSR Academy of Sciences Artobolevski voluntary joined the army in 1941. Fortunately, he served only three weeks when according to the order of the higher leadership of the country all the scientists were taken back from the front and active military activities, but the deed itself shows Artobolevski's immense conscience and patriotism, his true love to his Motherland!

Artobolevski's bibliography includes more than 1000 published works. Among them the main are:

«On Structure of Spatial Mechanisms» (1935), «Theory of Spatial Mechanisms» (1937), «Theory of Mechanisms and Machines» (1938), «Synthesis of Planer Mechanisms» (1939), «Fundamentals of United Mechanisms Classification» (1939), «Synthesis of Mechanisms» (1944), «Mechanisms», T. 1—4, (1947, 1949, 1951), «Acoustic Dynamics of Machines» (1969), «Mechanisms in Modern Engineering Design», Tom 1—4, (1970—1975), «Successes of the Soviet School on Theory of Machines and Mechanisms» (1977).

His textbooks are: «Theory of Mechanisms and Machines» (1940), «Course on Theory of Mechanisms and Machines» (1945) «Theory of Mechanisms» (1940, 1945, 1952, 1953, 1965, and several more editions). In his lectures Artobolevski always stressed that mechanical engineering is one of the most fundamental modern sciences.

Ivan Ivanovich wrote the first USSR monograph on spatial mechanisms and contributed to the areas of mechanism structure, kinematics, mechanism synthesis, and machine balancing. Together with his followers Nikolay Ivanovich Levitski and Sergey Aleksandrovich Cherkudinov Artobolevski developed a fundamental theory of planar mechanisms synthesis. He developed a system of mechanisms classification that became the basis for the whole MMS not only in the Soviet Union but all over the world.

Artobolevski's works on History of Machine and Mechanism Science are interesting and instructive as dedicated to the scientific legacy of Ivan Petrovich Kulibin, Nikolay Ivanovich Mertsalov, Pafnuty Lvovich Chebyshev (1821—1894), Nikolay Yegorovich Zhukovski (1847—1921), Sergey Ivanovich Vavilov (1891—1951), Vasily Petrovich Goriachkin, and Mikhail Vasiljevich Lomonosov. He always underlined a valuable contribution made by the Russian scientists to the formation of the scientific school on Machine and Mechanism Science (MMS). He also carried out a very detailed investigation dedicated to Leonardo da Vinci's legacy, and during the last years together with Alexei Nikolayevich Bogolubov, wrote a fundamental work «Leonid Vladimirovich Assur» where it was proved that some questions on mechanisms structure were worked out by Assur wider and deeper in comparison to the works of Burmester and Grubler.

A great number of Artobolevski's scientific works are translated into many foreign languages and published in dozens of countries.

Artobolevski took a great interest in everything modern and constantly put new tasks to his pupils and colleagues and actively developed new sections of TMM like acoustic dynamics of machines; theory of walking machines; theory of automatic systems; of multiple parameter and multicriterion synthesis of machines. Together with Aron Efimovich Kobrinski he gave a lecture «Some problems on construction of systems known as robots» and was the first to show the huge value of these machines in the future not only from the scientific and technical point of view, but also from the social and humanistic aspects. Artobolevski spoke of robotics as being one of the advanced directions of progress. He wrote:

«It is very important, that these systems allow to release of human beings from the work in zones of raised radio-activity, harmful and dangerous to health, from dust content, gassed condition, zones of heat and pressure».

His words were prophetic. Nowadays it is expected, that the robots of the subsequent generations possessing elements of an artificial intellect, can replace a Man in extreme situations: in space, under water on greater depths, under the ground, in the struggle against terrorism, and having left for a human being only functions of supervision, management and introduction of a complex system.

During the last years Artobolevski wrote one of his greatest works on «Successes of the Soviet school on Theory of machines and mechanisms», in which he summed up activity of all Soviet schools on TMM. His scientific ideas and the published works help acceleration of scientific and technical progress in the USSR.

Ivan Ivanovich Artobolevski edited a four-volume work «Mechanisms» after having worked on it for 10 years. The first edition, which was published in 1947—1952, contained a description of about 4,000 mechanisms applied by modern science. The first two volumes named «Mechanisms in Modern Engineering Design» were published in 1970 and 1971 and contained 2,228 lever mechanisms, including a description of 123 mechanisms made by Artobolevski like, for example, a link-lever ellipsograph, the mechanism for plotting and

rounding of ellipses and a hyperboloid, a link-lever hyper-bolograph.

His scientific activity was highly appreciated: in 1936 Artobolevski got a scientific degree of Doctor in Engineering Science, in 1939 he was elected a corresponding member of the Academy of Science of the USSR and in 1946, at the age of 40, he became an Academician on Mechanics. Due to his services for the development of national science and social activity, Artobolevski was awarded the highest title — the Gold Star of the Hero of Socialist labour and he got the highest reward — the Lenin Order six times!

In 1946 he received the Chebyshev award given by the Presidium of the USSR Academy of Science for the works «Synthesis of mechanisms» and «Scientific heritage of Pafnuty L. Chebyshev».

Academician Artobolevski also gained enormous recognition abroad. In 1967 the Institute of Mechanical Engineering of Great Britain awarded him James Watt Gold Medal, which is the highest award in the world given to engineers [5]. He became the 14th winner of this medal and the first Soviet scientist who has received it. Earlier the medal was conferred to the greatest mechanics and engineers of the world such as I. Sikorsky, G. Ford, A. Stodol, and G. Taylor.

Artobolevski carried out a remarkable work for the International Organization of Scientific Workers (IOSW) and in 1965 he was elected as its Vice-president. But before, in 1959, Artobolevski was awarded the Jolio Curie Silver Anniversary medal by the International Peace Council.

In 1968 Ivan Ivanovich Artobolevski was elected honorary member of the International Academy of History of Sciences since he published his works on TMM history.

Artobolevski died of heart failure on October 21, 1977. His life became a vivid example of scientific, social and state activity of a scientist, who did a lot to promote scientific and engineering programs for flourishing of Society.

The heritage of Artobolevski is a source of new ideas for many generations of engineers nowadays and in future. He always dreamed to design machines, facilitating people's life and doing their work more intellectual. He devoted his scientific life for prosperity of human beings.

In 2005 the Conference dedicated to the centenary of birthday of Ivan Ivanovich Artobolevski was celebrated in IMASH RAS where IFToMM President Professor Kenneth Waldron and Secretary-General Professor Marco Ceccarelli took part. All the participants underlined the great contribution of the scientist. The same year there was published a book «Scientific heritage. Ivan Ivanovich Artobolevski. Life and Science» written by his niece, and based on the real scientist's dairy [4].

Modern MMS widely applies achievements of all innovative sciences, from elementary particle physics, nanotechnology, and the conquest of outer space to genetic engineering. Ivan Ivanovich Artobolevski dreamt of IFToMM mission as to expand TMM horizons for prosperity of all people on the Earth, and it comes true.

Conclusions

IFToMM has a relevant significant role in the development both of Technology and Society. In today's aggressive world new IFToMMists need to be well aware of this and increase the visibility of it by developing mechanical engineering in terms of formation and innovation. The main task is to form

a new generation of engineers with a modern vision for the future. Thus, the future of IFToMM is with a great success like in the past, and even with more influence in the Society for the benefit of Society.

The IFToMM community works successfully when its members help each other and all together to contribute to the intellectual and scientific growths of the individuals and institutions within specific technical fields, advocating the primary mission of IFToMM that has a great potentiality more than in the past and it is proved today as a reality.

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