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Historia IFTOMM de Teoría de Máquinas y Mecanismos y Retos para su Educación D. Marco Ceccarelli

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RESUMEN ILUSTRADO

Educación en TMM (hoyendia MMS) es unos de los pilares de la Ciencia de Mecanismos (MMS) junto a Investigación y Transferencia Tecnológica para el desarrollo tecnológico a beneficio de la Sociedad. Se debate a varios niveles sobre la actualización de la formación de los ingenieros y a su fines culturales o mas bien de su apoyo al desarrollo de la sociedad con financiación siempre mas limitada, aunque se pide mas innovación y producción de mercado global. En ese contexto la internacionalización de las actividades, de formación y de profesión, se asumen como fundamentales. En este entorno tiene un papel importante la IFToMM en la area de la ingeniería mecánica moderna con su misión y actividades a nivel mundial. IFToMM se fundó en 1969 como Federación Internacional para promover MMS facilitando colaboraciones internacionales. En la conferencia se presenta la historia de la IFToMM con su características y actividades con el fin de indicar las posibilidades a la renovación de la formación académica de los ingenieros según motivaciones y situaciones del momento.

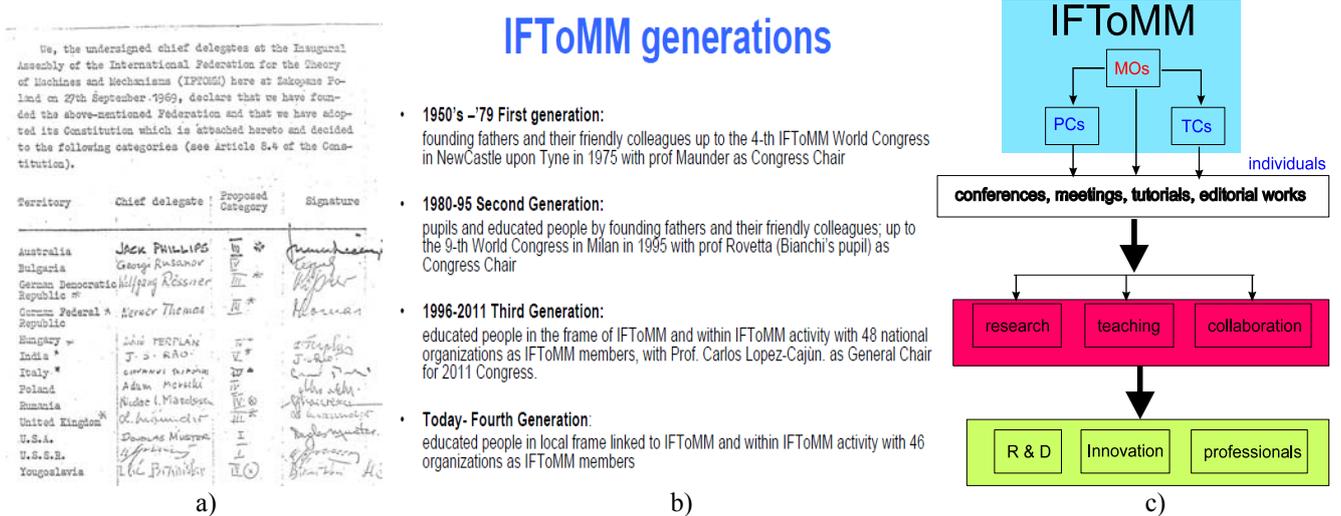
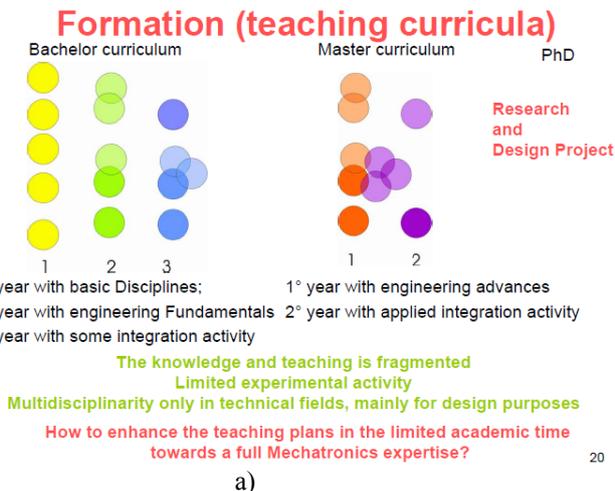


Figura 1. Historia y estructura de IFToMM: a) acto de fundación del 1969; b) generaciones de IFToMMistas; c) actividades.



The past reputation of engineers and technology scientists
Why today we lost such a reputation and consideration, although the society improvements still depend from technological developments, as clearly experienced in the past two decades?
But what happened and what is happening why Academic frames are losing the reputation and consequently the support of Society in the mission of formation of new generations of engineers. Is this only matter of costs?
Perhaps the mission of University needs to be reshaped as asked by political governors with different approaches and better efficiency?

a role of cultural significance even with long-term goals can be still vindicate to Universities, like in the past, as being the only frames in which the future can be shaped with new visions in the current but future generations.

Figura 2. Educación en MMS: a) estructura de la formación actual; b) preguntas para renovación.

IFToMM and its activity

The names of IFToMM, TMM, and MMS are related to fields of Mechanical Engineering concerning with Mechanisms in a broad sense. TMM is often misunderstood even in the IFToMM Community, although it is recognized as the specific discipline of Mechanical Engineering related with mechanisms and machines, as commented even in (Crossley 1970) announcing the birth of IFToMM. The meaning of TMM, now MMS, can be clarified by looking at IFToMM terminology (IFToMM 2003):

- Machine: mechanical system that performs a specific task, such as the forming of material, and the transference and transformation of motion and force.

- Mechanism: system of bodies designed to convert motions of, and forces on, one or several bodies into constrained motions of, and forces on, other bodies.

The meaning for the word “Theory” needs further explanation. The Greek word for “Theory” (θεωρία) comes from the corresponding verb, whose main semantic meaning is related both with examination and observation of existing phenomena. But, even in the classic Greek language the word theory includes practical aspects of observation as experiencing the reality of phenomena, so that theory means also practice with analysis results. In fact, this last aspect is what was included in the discipline of modern TMM when Gaspard Monge (1746-1818) established it in the Ecole Polytechnique at the beginning of XIXth century, (Chasles 1886), (see for example the book by Lanz and Betancourt (1808), whose text includes early synthesis procedures and hints for practical applications). Later (see for example Masi 1897) and even today (see for example Uicker et al. 2003) many textbooks have been entitled “Theory of Mechanisms” since they describe both the fundamentals and the applications of mechanisms in machinery.

The term MMS has been adopted within the IFToMM Community since the year 2000 after a long discussion (see (Ceccarelli 1999) in the IFToMM Newsletter), with the aim to give a better identification of the modern enlarged technical content and broader view of knowledge and practice with mechanisms. Indeed, the use of the term MMS has also stimulated an in-depth revision in the IFToMM terminology since the definition of MMS has been gives as, (IFToMM 2003):

- Mechanism and Machine Science: Branch of science, which deals with the theory and practice of the geometry, motion, dynamics, and control of machines, mechanisms, and elements and systems thereof, together with their application in industry and other contexts, e.g. in Biomechanics and the environment. Related processes, such as the conversion and transfer of energy and information, also pertain to this field.

The developments in TMM have stimulated cooperation around the world at various levels. One of the most relevant results has been the foundation of IFToMM in 1969, Fig. 1. IFToMM was founded as a Federation of territorial organizations but as based on the activity of individuals within a family frame with the aim to facilitate co-operation and exchange of opinions and research results in all the fields of TMM as stressed in (Crossley 1970). Many individuals have contributed and still contribute to the success of IFToMM and related activity, (see IFToMM webpage: www.iftomm.org) under a coordination of IFToMM Presidents over time.

IFToMM was founded as the International Federation for the Theory of Mechanisms and Machines in Zakopane, Poland on September 27, 1969 during the Second World Congress on TMM (Theory of Mechanisms and Machines). The main promoters of the IFToMM World Federation were Academician Ivan I. Artobolevski (USSR) and Prof. Erskine F.R. Crossley (USA), whose principal aim was to bypass the obstacles of the time of the Cold War in developing international collaboration in TMM science for the benefit of the world society. IFToMM started as a family of TMM scientists among whom we may identify the IFToMM founding fathers, who signed or contributed to the foundation act with the initial 13 Member Organizations, referring to the persons, Fig.2: Academician Ivan I. Artobolevski (USSR), Prof. Erskine F.R. Crossley (USA), Prof. Michael S. Konstantinov (Bulgaria), Dr. Werner Thomas (GFR), Prof. B.M. Belgaumkar (India), Prof. Kenneth H. Hunt (Australia), Prof. Jan Oderfeld (Poland), Prof. Jack Phillips (Australia), Prof. George Rusanov (Bulgaria), Prof. Wolfgang Rössner (GDR), Prof. Zènò Terplàn (Hungary), Prof. Jammi S. Rao (India), Prof. Giovanni Bianchi (Italy), Prof. Adam Morecki (Poland), Prof. Nicolae I. Manolescu (Romania), Prof. Leonard Maunder (UK), Prof. Douglas Muster (USA), Prof. Ilic Branisky (Yugoslavia).

The foundation of IFToMM was the result of an intense activity for stimulating and promoting international collaboration, more than what had been done previously, and the process started in the late 1950s', as documented by several letters that are stored in the IFToMM Archive at CISM in Udine, Italy. A first World Congress on TMM (Theory of Mechanisms and Machines) was held in Varna, Bulgaria during which the foundation of IFToMM was planned as later it was agreed during the Second World Congress on TMM in Zakopane, Poland. The Congress series was immediately recognized as the IFToMM World Congresses and in 2011 we have celebrated the 13th event with the participation of delegates from 46 Member Organizations and from more than 50 countries.

IFToMM activity has grown in many aspects, as for example concerning the number of member organizations (from the 13 founder members to the current 46 members), the size and scale of conference events (with many other conferences, even on specific topics, at national and international levels, in addition to the MMS World

Congress), and the number and focus of technical committees working on specific discipline areas of MMS. IFToMM was founded in 1969 and today a fourth generation of IFToMMists starts to be active, as they can be named as those working within the IFToMM community. Knowing the History of IFToMM and how we arrived at today's modus operandi gives a greater awareness of community identity and significance.



Fig. 2 First IFToMM President Artobolevskii speaking at the foundation of IFToMM, (Courtesy of IFToMM Archive): 1- prof. Ivan Ivanovic Artobolevskii (USSR); 2- prof. Adam Morecki (Poland); 3: prof Kurt Luck (Germany) ; 4- Prof. Michale S. Konstantinov (Bulgaria); 5- prof. Nicolae I. Manolescu (Romania); 6- prof. Erskine F. Crossley (USA); 7- prof. Giovanni Bianchi (Italy); 8-prof. Aron E. Kobrinskii (USSR); 9- prof. Werner Thomas (Germany); 10- prof. Jan Oderfeld (Poland).

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

- 1950's –'79 First generation: founding fathers and their friend colleagues up to the 4-th IFToMM World Congress in Newcastle-upon-Tyne in 1975 with prof. Leonard Maunder as Congress Chair
- 1980-95 Second Generation: students and people educated by founding fathers and their friend colleagues; up to the 9-th World Congress in Milan in 1995 with prof. Alberto Rovetta as Congress Chair
- 1996-2011 Third Generation: educated people in the frame of IFToMM and within IFToMM activity with 48 national organizations as IFToMM members, with Prof. Carlos Lopez-Cajùn. as General Chair for 2011 Congress.
- Today- Fourth Generation: educated people in local frames that are linked to IFToMM and within IFToMM activity with 46 organizations as IFToMM members

IFToMM officers (who are the Chairs of IFToMM Member Organizations, the Chairs of TCs and PCs, and the members of the Executive Council) have contributed and still contribute as leaders for the mission of IFToMM, which is stated in the 1-st article of the Constitution as: 'The mission of IFToMM is the promotion of Mechanism and Machine Science'. A complete list of IFToMM officers over time is available in the Proceedings of the second International Symposium on History of Machines and Mechanisms HMM2004 that was published in 2004 by Kluwer/Springer and is now available also in the IFToMM webpage.

In particular, Presidents and Secretaries General have had significant roles in guiding the growth and success of IFToMM. Their personalities are also representative of the IFToMM community in terms of reputation and visibility worldwide. The Presidents were: Ivan I. Artobolevsky (1969-1971 and 1972-1975) (USSR), Leonard Maunder (1976-1979) (UK), Bernard Roth (1980-1983) (USA), Giovanni Bianchi (1984-1987 and 1988-1991) (Italy), Adam Morecki (1992-1995) (Poland), Jorge Angeles (1996-1999) (Canada), Kenneth J. Waldron (2000-2003 and 2004-2007) (USA), Marco Ceccarelli (2008-2011) (Italy), and Yoshihiko Nakamura (2012-2015) (Japan), Fig. 3. The Secretaries General were Michael S. Konstantinov (Bulgaria), Emil Stanchev (Bulgaria), Adam Morecki (Poland), Elizabeth Filemon (Hungary), L. Pust (CSSR), Tatu Leinonen (Finland), Marco Ceccarelli (Italy), and Teresa Zielinska (Poland)

Details of the History of IFToMM can be found in the first Chapter of the Proceedings of the first International Symposium on History of Machines and Mechanisms HMM2000 (that was published by Kluwer) in which all the past IFToMM Presidents have outlined their historical perspective of IFToMM in contributed papers with references, (Angeles et al., 2004). Additional references can be indicated as (Maunder 1980 and 1988; Morecki 1985 and 1999; Crossley 1988 and 1991; Ceccarelli 2004c, 201, 2011, and 2013). More information on IFToMM and its activity can be found in the website: <http://www.iftomm.org>.



Fig. 3 IFToMM Presidents: a) at HMM 2000 in Cassino (Italy); b) the current President.

The structure of IFToMM is summarized in Fig. 4 where the action of IFToMM Bodies is indicated as from IFToMM constitution for a flow of activities. According to IFToMM mission as in the constitution, the IFToMM activity is finalized to provide leadership for cooperation and development of modern results in the Mechanism and Machine Sciences by assisting and enhancing international collaboration.

The bodies of IFToMM can be described synthetically as:

- **General Assembly:** it is the supreme body of the Federation and determines its policy. It is composed of the Chief Delegates of IFToMM Organization members (in 2013 they are 46) and members of the Executive Council.
- **Executive Council:** it manages the affairs of the Federation between the sessions of the General Assembly. It is elected every four years, meets annually, and is composed of the President, Vice- President, Secretary-General, Treasurer, and six ordinary members.
- **Permanent Commissions (PCs) and Technical Committees (TCs):** Each PC and TC is composed of a Chairperson, appointed by the Executive Council, a Secretary and members, nominated by the Chairperson and appointed by the Executive Council. A Chairperson shall not serve for more than two terms consecutively. The general goals for the work of the PCs and TCs are aimed at promoting their fields of interest by attracting researchers and practitioners, including young individuals, in order to:
 - define new directions in research and development within their technical areas;
 - establish contacts between researchers and engineers;
 - initiate and develop bases and procedures for modern problems;
 - promote the exchange of information;
 - organize national and international symposia, conferences, summer schools, and meetings.

In 2013 13 TCs are activate in the fields of: Biomechanical Engineering, Computational Kinematics, Gearing and Transmissions, Linkages and Mechanical Controls, Micromachines, Multibody Dynamics, Reliability,, Robotics and Mechatronics, Rotordynamics, Sustainable Energy Systems, Transportation Machinery, Tribology, and Vibrations. Additional TCs are under consideration for hot topics with an IFToMM significant community. The PCs are on: Communications, Publications and Archiving, Education, History of MMS, and Standardization of Terminology.

Main aspects of the IFToMM activity are emphasized in Fig.7 as related to Research, Teaching, and Collaboration for final goals in R&D frames, Innovation, and Professionals Formation. Indeed, they are related to each other since a good teaching for a modern professionals formation needs to be well based on a successful research activity that today requires collaborations in teams even within international frames for shared approaches and results.

IFToMM activity can be summarized mainly in:

- conference events, in wide form and specific subjects not only as linked to TCs, at local and international frames, within series and in one shot events. A World Congress is organized every 4 years and the next one is 14th IFToMM World Congress that is scheduled on 25-30 Octobe, 2015,in Taipei (<http://iftomm2015.yohoz.com>)
- meetings and visit exchanges, including joint teaching
- project collaborations in research programs and in teaching plans
- organization of fields of interests for aggregation of an international community and planning actions as the above ones

- publications for dissemination purposes of research results and knowledge transfer. This is achieved at the moment through 6 affiliated journal and two book series specifically dedicated to MMS and IFToMM community. The journals are: Mechanism and Machine Theory (<http://www.elsevier.com>), Problems of Mechanics (<http://pam.edu.ge>), Open-access Mechanical Sciences (<http://www.mech-sci.net>), Chinese Journal of Mechanical Engineering (<http://www.cjmenet.com>), Advances in Vibration Engineering (<http://www.tvi-in.com/index.asp>), Mechanics Based Design of Structures and Machines (<http://www.tandf.co.uk/journals/titles/15397734.asp>). The book series are published by Springer on MMS (<http://www.springer.com/series/8779>) and on History of MMS (<http://www.springer.com/series/7481>).

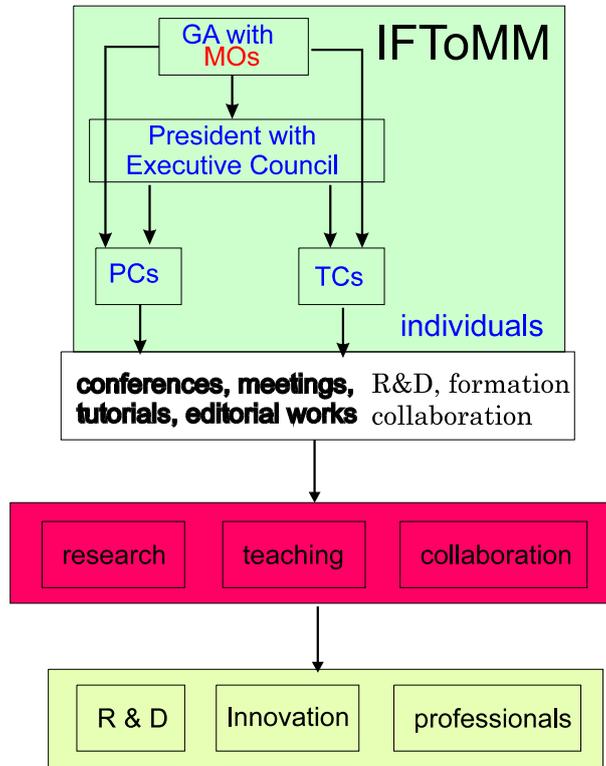


Fig. 4 A scheme for structure and activity of IFToMM

IFToMM significance can be summarized as being the unique world federation in MMS with the following motivations:

General Assembly: it is the supreme body of the Federation and determines its policy. It is com

- Yesterday: To start and facilitate international collaboration between Eastern and Western countries
- Today: To help and enhance international collaboration and modern results on MMS
- Tomorrow: To leader cooperation and development in MMS Mechanism and Machine Science

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