

ON THE PROGRESS OF STANDARDIZATION OF MECHANISM AND MACHINE SCIENCE TERMINOLOGY

T.G. Ionescu[^] A. J. Klein Breteler* T. Leinonen** G. Boegelsack*[^]
C.F.R. Passenger Delft University Oulu University Ilmenau University
Bucharest, Romania Delft, Netherlands Oulu, Finland Ilmenau, Germany

Abstract – *The paper deals with the progress in time of standardization of Mechanism and Machine Science terminology. Historical and methodological aspects of the work done by the specialized IFToMM Commission are presented, as well as some of its important achievements. The paper offers an overview beginning with the early days, going through the present preoccupations and revealing future proposed tasks.*

Keywords: machines and mechanisms, terminology, history, methodology, outcomes.

I. Establishment of the commission for standardization of terminology

The constituent meeting of the commission for “Standardization of Terminology” was held on 18 September 1971, during the 3rd World Congress on the Theory of Machines and Mechanisms in Kupari, Yugoslavia. There were five participants: Professors Bazjanac (Yugoslavia), Bianchi (Italy), Bögelsack (GDR), Davies (United Kingdom) and Keller (GFR).

As Professors D. Muster (USA) and N. I. Levitskyi (SU), pre-nominated by the Executive Council as chairman and vice-chairman, respectively, of the Commission did not attend the Congress, the constitutive meeting was chaired by Prof. T. Davies. Initial lists of terms were already submitted by United Kingdom and GDR during the meeting, and a provisional program with responsibilities and a set of rules was established [1].

From the very beginning, the objectives of the commission were to establish a specific and unitary terminology for MMS. In the past, several national and international groups had successfully endeavoured to compile dictionaries and glossaries in this field. Some related publications can be mentioned as examples: In [2] are listed 90 terms in Russian, English, French and German, but defined in the Russian language only. A preceding academic bulletin was published in 1938. The German glossary [3] contains 221 terms and definitions illustrated by sketches and drawings. Dictionary [4] includes 610 terms in German, English, French, Russian and Bulgarian without definitions.

These very useful results had to be compiled and complemented significantly. Above all, definitions should appear in all of the four official IFToMM languages.

The IFToMM Constitution & By Laws stipulates: “*The Permanent Commission for the Standardization of Terminology has to write a standard terminology (with definitions) for mechanism and machine science, including terms pertaining to the realization of motion in machines and its control, associated problems in dynamics and kinematics, and in machine components; to cooperate with other international and national bodies concerned with terminology and related matters.*”

II. Methodological and organizational aspects of the work

In view of the demand that a well-made definition should distinguish by identifying and identify by distinguishing, the commission reached an agreement on the following rules to be observed in the methodology of defining:

- In each context, it must be possible to replace the term to be defined (*definiendum*) by the definition (*definiens*);
- A definition may neither contain nor cause logic contradiction;
- The term to be defined may not appear in the definition either openly or as concealed (circular definition);
- The predicate of a definition should not be negative;
- *Definiendum* and *definiens* must be identical in extent;
- A term should be neither overdefined (more characteristics in the definition than in the term) nor underdefined.

Some more guidelines were proposed later by Prof. J. M. Prentis [5]:

- Terms should be elegantly defined in the simplest possible language;
- Definitions should be concise;
- Terms should not be needlessly multiplied, e.g. (common adjective) + (old term) = (new term);
- Terms should not be included (or, even worse,

[^] E-mail : theodor.ionescu@cfr.ro

* E-mail : a.j.kleinbreteler@wbmt.tudelft.nl

** E-mail : tatu@me.oulu.fi

*[^] E-mail : gerhard.boegelsack@tu-ilmenau.de

invented) simply to provide a counter-point to other terms;

- A term that is easier to understand than the definition should be deleted unless a simpler definition can be found;
- When in doubt, leave it out!

As a rule, Commission working meetings have been organized, with rare exceptions, every two years:

1971	Kupari/YU	1989	Smolenice/CSSR
1973	Nieborów/PL	1990	Oulu/SF
1975	Warszawa/PL	1992	Poitiers/FR
1976	Oberhof/GDR	1994	Delft/NL
1978	Genova/IT	1996	Warszawa/PL
1980	Miskolc/HU	1998	Brno/SK
1982	Cambridge/GB	2000	Kaunas/LT
1984	Braşov/RO	2002	Mezötur/HU
1986	Siegen/GFR	2005	Bardejov Spa/ SK
1988	Niš/YU		

The next meeting is scheduled for 2008 in Lyon, France. Additional brief meetings were held during the World Congresses: 1987 Seville / ES, 1991 Praha / CSSR, 1995 Milan / IT, 1999 Oulu / FI, 2004 Tianjin / CN and SYROM Conferences: 1977, 1981, 1985, 1997, 2001 Bucureşti / RO.

In between the meetings the activity was run in teams / subcommissions of specialists, structured on the domains of interest. Nowadays, the following subcommissions are operating : “Structure and Kinematics”, “Dynamics”, “Robotics”, “Biomechanisms”, “Mechatronics”, “Gearing”, “Micro and Nanomechanisms”, “Electronic Dictionary”, “New Ordering System”, “Basics”, “Transportation”.

The chairmen of the commission have been D. Muster (1972 / 1976), G. Bögelsack (1976 / 1986), J. Prentis (1986 / 1990), T. Leinonen (1990 / 1998), T. Ionescu (1998 / 2005), A. J. Klein Breteler (since 2006).

III. Terminology achievements in time

Initially, a master version in English was set up and published in the IFToMM Journal, Mechanism and Machine Theory Vol. 18, No. 6, 1983 by a team chaired by Prof. G. Bögelsack. [6] Useful comments were received and incorporated into the subsequent draft. A four-language glossary in English, French, German and Russian was then published in the same journal, Vol. 26, No. 5, 1991 by a team chaired by Prof. T. Leinonen. [7] It contained 763 terms and their definitions and was divided into the following chapters and subchapters:

- Structure of Machines and Mechanisms (Components, Sub-assemblies; Mechanisms)
- Kinematics (General; Motion; Kinematic Geometry)

- Dynamics (General; Force and Moment; Momentum, Energy, Work and Power, Principles; Structural Behaviour and Characteristics; Structural Concepts; Dynamical Concepts; Dynamical Systems and Characteristics; Vibrations)
- Machine Control and Measurements (Signals and Functions; Accuracy and Errors; Devices and Components)
- Robotics (Systems; Components; Motion; Control; Miscellaneous)
- Appendix (General Terms Used in TMM).

As a continuation, a standard set of “Abbreviations / Symbols for Terms in TMM” and “Graphical Symbols for the Representation of Mechanisms” was finalized and published in MMT Journal Vol. 32, No. 6, 1997. [8]

The activity on the enhancement of MMS terminology continued in the years 1998 – 2003 on two directions: updating and enriching the available chapters as well as adding new specialized sections, such as nonlinear oscillations, biomechanisms, mechatronics, rotordynamics, gearing, and stability with the anticipated science and technology developments. The entire activity aimed at:

- facilitating the adoption of new terms and their insertion among the existing ones, with minimum reworking of numbering and indexes;
- permitting independent, modular enhancement of any section/chapter of terminology;
- increasing reader accessibility to terms and definitions;
- making the terminology more user-friendly and usable for extensive application.

Cooperations inside IFToMM, with the TC for “Nonlinear Oscillations” and the “Gearing” TC were established with remarkable results. As well, many specialists outside Commission A were consulted and have contributed . A decision of adopting a new, more flexible and reliable system of organizing terms, in pace with the actual premises was also taken [9].

At the 20th Commission meeting (Mezötur, 2002), the draft of the new printed version of the MMS terminology was completed. Subsequently, this was approved by the IFToMM Executive Council at its meeting in 2002 (Udine), and eventually, the 3rd edition of the MMS terminology appeared in the Mechanism and Machine Theory journal Vol. 38, Nos. 7 – 10, 2003. This last printed edition contains [10]:

- a “basic core” of 771 terms and definitions in the English, French, German, Russian languages obtained by revising / updating, completing (with System & Model and Robotics terms) and partly rearranging the 1990 edition. There are seven chapters: Generalities, Structure of Machines and Mechanisms, Kinematics, Dynamics, Machine Control and Measurements, Robotics, General

Terms used in MMS, which are partly consistent with the natural structure and divisions of MMS;

- a “supplement” of 823 terms and definitions in English was obtained by developing the existing and new MMS subdomains as Dynamics, Rotordynamics & Measurement, Vibrations & Oscillations, Stability, Biomechanics, Gearing, Mechatronics. There are seven new chapters, some of them are alphabetically arranged to facilitate future development. These chapters express the actual trends and challenges in MMS as well as IFToMM Technical Committee’s preoccupations.

IV. Four language on – line glossary

In the past decades development of computer technology pushed, while the IFToMM community pulled, the demand for an electronic version of the IFToMM dictionary. The functionality should roughly be that of a four-language glossary with an index list, and it should have *references* as hyperlinks instead of <references> in braces as in the printed version.

Such a product could be made and maintained manually, after that the text files are completely edited. In this case however the text files are edited and maintained by a sub-commission for each chapter, so a chief-editor for each language would be required to do the job. It was also recognized that terminology is subject to discussion, extension and modification almost permanently. This brought the insight that it would be better to create the electronic dictionary automatically, which means by a computer program, starting from the commission’s working documents (text editor Word) as input.

Consulting a software specialist a program structure was developed. To be prepared for more languages, a set of bi-lingual dictionaries with all possible combinations was aimed. The final product is thus a set of dictionary files (here CHM-files or Compiled HTML-files) for each pair of languages. To allow reading in all text files and storing the data in one table (internal database) a certain standardization of the working files was required. Certain rules for editing the Words files were needed then and the commission members had to work very accurate according these rules. To make use of general available software (like here the HTML-help compiler) an intermediate conversion to XML-textfiles was beneficial. The XML-files serve then also the creation of derived products like the online Web-version of the dictionary and printouts [11].

A crucial step in the conversion to XML is the inclusion of hyperlink data, which has to be done of course automatically by the dictionary creating program [12]. Finally, with great support of the software specialist, the first version of the electronic IFToMM terminology dictionary was created in January 2004. It was

successfully demonstrated at the IFToMM World congress in Tianjin.

Current activities concern:

- Finish the Word files of chapters 7 up to 13 for all languages. Just the translation for one of the languages is still under development ;
- Extend the dictionary creation program regarding the functionality on the Web. Finally it should be equal to that of the CHM-files.

V. Aims and tasks for the future

Some important directions of development are:

- continuous enhancement, enrichment and updating of the MMS terminology; inclusion of new related terminological domains;
- finalization of the alphabetical, data-based and computer-aided terminology (“Electronic Dictionary”);
- consideration of CD – ROM and/or the IFToMM Internet site as preferred media for the future editions of the terminology;
- creating a web site of our PC for “Standardization of Terminology” and linking it to (the main) IFToMM site;
- amplification of exchange and cooperation on terminological matters with IFToMM Technical Committees and Permanent Commission and with other qualified institutions;
- enrolment of new active members for the augmentation of the Commission’s outcomes.

VI. Conclusions

As far as the basic character of our terminology is concerned, a choice between a general version for widespread use and a strictly limited, specific version has to be made. Although there has been some criticism of the present development of our terminology, which takes over terms from other sciences and technical fields, the criterion of utility must be respected. It is our belief that most professionals related to and working in the MMS discipline do need proper reference documentation covering, in terms and definitions, every notion and conceptual category in use. (However, if found necessary, a differentiation mark between “own” and “borrowed” terms can be formally introduced in the future editions.)

Regarding the need for a proper working instrument, the Commission must be able to focus and develop its activity in a continuous and efficient way and with good results. This implies organizational and structural measures promoting creative work, an activity plan with tasks for each subcommission and for every member, responsibilities, schedules, cooperation, etc.

As the TMM terminology must express globally our

federation's concerns and keep in touch with the latest developments and achievements in science and technology (TMM 21 topics), it seems evident, on the one hand, to ask for a full cooperation with the IFToMM TCs and PCs (which dealing with specific problems, use and develop specific terminologies). On the other hand, a timing to suit the actual circumstances and enlargement of our Commission are inevitable in order to cope with the present and future terminological tasks. In this views, delegated representatives of the IFToMM TCs / PCs are most welcome to our Commission. .

The MMS terminology is historical in character, similarly to MMS itself; it reflects a certain stage of existence and technical & scientific development. But terminology must be also viewed as a science, "La terminologie est la science des terms: elle etudie leurs caracteristiques, notamment les lois linguistiques et socio – psychologiques de leur naissance et de leur evolution", with a marked historical pattern. [13]

Wishing to pay homage to all those professionals involved, with mind and heart, in MMS terminology, this paper is also an invitation towards the entire MMS Community at large to join the future efforts of the Permanent Commission for „Standardization of Terminology” and serve the scientific and engineering world audience.

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