TERMINOLOGY
for the
MECHANISM and MACHINE SCIENCE

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International Federation for the Promotion
of Mechanism and Machine Science (IFToMM)

V.A. Belyi Metal-Polymer Research Institute
of National Academy of Sciences of Belarus, (MPRI NASB), Gomel, Belarus

Saint-Petersburg National Research University of Information Technologies,
Mechanics and Optics (ITMO University), Saint-Petersburg, Russia

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Edited by
Victor Starzhinsky and Eugeni Shalobaev

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This volume contains the papers presented at the Scientific Seminar in the framework of the 25th Working Meeting of IFTOMM Permanent Commission for Standardization of Terminology on MMS. The authors present the scientists from Belarus, Germany, Italy, the Netherlands, Russia, Serbia. The information on IFTOMM activity including the paper prepared by scientists from CIS and post-Soviet countries in the field of MMS terminology is considered. A review on development of the theory and practice of gearing is introduced. MMS section problems, such as Gearing, Mechatronics, Biomechanics, Compliant Mechanisms and Machine Quality, are discussed. Second edition has been supplemented with fresh information about MMS news and IFTOMM activities over the period of 2014-2016.


Reviewers:
Dr. Science (Eng), Prof.
P.N. Gromyko
Dr. Science (Eng), Prof.
G.P. Tarikov

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PREFACE ON THE SECOND EDITION

The first edition of this proceedings was published in 2015 with limited number of copies and hard version was distributed to a limited contingent IFToMM members and members of IFToMM Permanent Commission “Standardization of Terminology for MMS” (IFToMM PC A) (Prof. I. Biro, Prof. T. Brix, Prof. M. Ceccarelli, Prof. V.I. Goldfarb, Prof. A.J. Klein Breteler, Dr.-Ing. N.T. Pavlovic).

Taking into account the above, as well as the emergence of a sufficiently large volume of scientific and technical information that is directly relevant to the subject of this volume during the past period, the publishers' offer new, second edition of the proceedings, supplemented with fresh information about MMS news and IFToMM activities.

Let us consider the changes and additions made in the second edition.

Appendixes 1-3 have been moved from the first edition to the second one without alterations.

The report [1], among other reports, was represented by authors from Belarus in May 2015 during Workshop on History of Mechanism and Machine Science (HMMS 2015, St-Petersburg, Russia, May 26-28, 2015). It contained the results of participation of Belarusian scientists (as experts, chairpersons of subcommittees and editors) in development of Gearing Terminology in the framework of IFToMM PC A, as well as the creation of Reference-Dictionary Book on Gearing [2] and Interstate Standard on Gear Failure Modes [3].

According to the materials of the report, the paper [4] has been prepared for publication in a scientific and methodological journal TMM (TMM, SpBSTU, RU).

The reports on the history of TMM presented at the Workshop HMMS 2015 have been published in the Special Issue [5] (List of publications see in Appendix 4).

Work on MMS Terminology in 2016 was continued in the form of reports [6, 7] prepared for presentation at the Joint International Conference "MTM-Robotics 2016" (Aachen, Germany, October 26-27, 2016) which examines the current state of individual sections of MMS terminology, makes proposals for their further development, as well as provides information about the contribution of scientists of the former USSR and CIS countries in the development of terminology in the framework of IFToMM PC A.

Within this context it is worth mentioning that some individual reports submitted in 2014 at the International Symposium “Theory and Practice of Gearing” (January 21-23, 2014,
Izhevsk, Russia) [8] have been collected for publication in a special issue [9].
It is pertinent to note that Belarusian scientists (Academician N.K. Myshkin and Prof. V.B. Algin) took part in the 14th IFToMM World Congress in Taipei (October 25-30, 2015, Taipei, Taiwan) and presented the topics [10, 11]. In the frame of the 14th IFToMM World Congress the Informal Working Meeting of IFToMM PC A has been held (The Meeting Agenda see in Appendix 5).
The noticed inaccuracies or typographical errors have been corrected in the papers, certain papers have been recycled or supplemented with fresh information. The most fundamental changes have been introduced into the paper of A. E. Volkov and D.T. Babichev "The History of Theory of Machines and Mechanisms and Theory of Gearing": brief and insufficiently informative report on the history of TMM in ancient and medieval times which is thematically not relevant to the general context and is mainly focused on the detailed description of gear transmission theory in Russia and the Soviet Union was ruled out. The revised paper largely corresponds to its Russian-language version [12].
The publishers would like to thank Tamara A. Isaieva, Victoria V. Domasik, Ekaterina M. Petrokovets, Larisa S. Pushkina and Rada A. Yurjeva for preparation of the manuscript to publication.

REFERENCES


Prof. V.E. Starzhinsky
Prof. E.V. Shalobaev
Saint-Petersburg. At the entry to Hotel “Penguin”. Left to right: Commission’s Members: Prof. I. Bíro, Prof. E. Shalobaev, Prof. V. Starzhinsky and Candidate for observer Dr. S. Shil’ko attended the Meeting
PREFACE ON THE FIRST EDITION

IFToMM Permanent Commission A (PC A) activities till 2009 inclusive have been described in detail in articles [1, 2], see the Proceedings of Scientific Seminars on the subject at the 21st and 23rd Working Meetings of Commission A.

While the Commission continues to pursue the activities which are traditional in form to the ones described in the aforementioned papers, it should be noted that the following members took part in the 23rd PC A Working Meeting: P. Antonesku, I. Biro, T. Brix, B. Corves, M. Kane, A. Klein Breteler (Chairman), V. Starzhinsky, T. Tolocka (June 21-26, 2010, Minsk-Gomel, Belarus); expert E. Shalobaev received an observer status at the Meeting.

The results of interactions with subcommissions, organizational and information activities of the Commission, interface with similar structures (Permanent Commissions and Technical Committees of IFToMM, ISO working groups, and universities) were discussed. A new structure and contents of Chapter 12 “Gearing” were discussed and the terms were arranged under seven subsections. Prof. A. Klein Breteler presented Chapter 14 “Transportation Machinery and Logistics” consisting of six subsections.

Eighteen reports were presented at the scientific seminar [3]. On the occasion of the 40th Anniversary of the IFToMM and Commission A the guests and sponsors of the Meeting were awarded with Special Certificates, signed by IFToMM President, Prof. M. Ceccarelly and PC A Chairman, Prof. A.J. Klein Breteler.

The 24th Meeting of the Commission (June 24-30, 2012, Ilmenau, Germany) was attended by O. Antonescu, P. Antonescu, T. Brix, B. Corves, U. Doering, M. Kane, A. Klein Breteler (Chairman), Z. Lan, T. Leinonen, N. Pavlovic, V. Starzhinsky.

Traditionally, subcommission reports were presented.

New sections on terminology were discussed: Chapter 15. Quality indices of machines and their components (M. Kane / V. Starzhinsky). Chapter 16. Compliant mechanisms (N. Pavlovic / L. Centner / Yue-Qing Yu.).

Seven reports were presented at the scientific colloquium on the subject. Since the proceedings of the Colloquium were not published, we think it would be appropriate to list them as follows:

Starzhinsky V.E. et al.: Double-Flow Toothed Mechanisms: PC-Aided Design in Terms of
Reducer Volume Optimization Criterion.
Pavlovic N.T. and Pavlovic N.D.: Modelling of a Compliant Scott-Russel Mechanism with Small Length Flexural Pivots.
Kane M.M. and Starzhinsky V.E.: Principles of Creation and Contents of the New Chapter of IFToMM Terminology “Quality Indices of Machines and Their Components”

Since the 24th PC A Meeting the members have participated in various scientific events held within the IFToMM framework. In particular, Profs. M. Kane, V. Starzhinsky and E. Shalobaev attended and made reports at the International Symposium “Theory and Practice of Gearing” dedicated to the 100-anniversary of Prof. F.L. Litvin, a noted scientist in the field of gearing (January 21-23, 2014, Izhevsk, Russia) [4].

Within the scope of the Symposium a Meeting of the Technical Committee “Gearing” was held where it was announced that the International Journal of Design Engineering had become the Committee’s official publisher. The idea of resuming the publication of Journal “Gearing and Transmission” which was closed several years ago is under discussion.

The next symposium on the theory and practice of gearing is planned to be held in 2017 in Cartagena, Spain at the Polytechnic University of Cartagena (Prof. A. Fuentes).

Within the frame of the Symposium, scientific events planned for 2014 and 2015 under the IFToMM’s aegis were announced:

* International Symposium on Robotics (Moscow, Russia, June 23-27, 2014).
* An IFToMM Workshop on the History of Mechanisms and Machines Science (St. Petersburg, Russia, May 26-28, 2015).
* International Conference “Graph Modelling in Engineering” (Belsko-Biala, Poland, June 22-24, 2015).
* IFToMM World Congress (Taipei, Taiwan, October 25-30, 2015).

Prof. M. Ceccarelli (IFToMM President from 2008 till 2011) who attended the Symposium was invited to the 25th PC A Working Meeting in St. Petersburg; he is programming to make a report which is published in this book.

We apologize to the Commission members whose scientific activities outside the scope of the Commission have not mentioned here.

At the suggestion of Prof. M. Ceccarelli and in implementation of the decisions adopted by the Symposium, a group of participants composed of Prof. Victor E. Starzhinsky (Gomel, Belarus), Prof. Viniamin I. Goldfarb (Izhevsk, Russia), Prof. Vladimir B. Algin (Minsk, Belarus), Prof. Eugeni V. Shalobaev (St-Petersburg, Russia), Prof. Mark M. Kane (Minsk, Belarus) has prepared a publication on the work of scientists from CIS countries within the framework of the IFToMM activities.

Prof. Andrei E. Volkov (Moscow, Russia) and Prof. Dmitry T. Babichev (Tomsk, Russia) have prepared a report on the role of scientists of CIS countries in the development of the theory of machines and mechanisms, gearing theory in particular, which is published in this collection. The last report contains detailed notes to the editors.

To visualize the links between the recommendations of the PC A and other credible sources
like encyclopedias, in particular, the Large Russian Encyclopedia, a report was prepared by Prof. Yuri V. Poduraev (Moscow, Russia) and Prof. Eugeni V. Shalobaev (St-Petersburg, Russia), the authors of numerous works on mechatronics and robotics, and articles written for the encyclopedia.

In conclusion, it is important to note that just after the papers on Chapters 15 and 16 for the given proceedings were ready, additional information - updated version of Chapter 15 (Prof. A. Klein Breteler) and the suggestion to include new terms into Chapter 16 (Dr. N. Pavlovic) - appeared.

Presentation of Dr. Sergei V. Shil’ko entitled “Mesomechanical Analysis of Adaptive Structures Made of Biological Tissues and Functional Materials” is included in Appendix 1. The organizers considered it important to add information in the field of compliant mechanisms with illustrations which have been kindly provided by Prof. N. Pavlovic (Appendix 2).

In Appendix 3 a portrait of Leonardo Euler (the famous scientist who proposed to use involute for description of tooth profile in gear meshing) drawn by Anna Biro (daughter of Prof. Istvan Biro and Eva Biro) who attended the PC A 25th Working Meeting is presented.

The Organizing Committee of the 25th Working Meeting thanks the following employees of V.A. Belyi MPRI NAS Belarus – Tamara Isayeva, Larisa Pushkina, Valentina Moiseenko, Ekaterina Petrokovets, Tatyana Ryabchenko, Sergei Shil’ko and employees of ITMO University Rada Yurjeva, Galina Yurkova, Olga Kozyreva for their assistance provided to the organizers of the meeting, translation of texts and preparation of the manuscript for publication.

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Prof. E.V. Shalobaev
Prof. V.E. Starzhinsky
Participants of the Meeting. Left to Right:
Prof. I. Bíro, Prof. E. Shalobaev, Dipl. Eng. O. Kozyreva,
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