Program of J-P. Merlet as candidate for IFToMM presidency in 2015

Move toward the future but preserve the past

October 2015

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1 Introduction

The purpose of this document is to present myself, my motivation for becoming the next President of IFToMM and my view on the future of the Federation.

1.1 A short CV

My current position is, roughly translated, research director of exceptional class at INRIA, the French National Research Institute in Computer Science and Control Theory where I started as researcher in 1984, after the completion of an engineering degree in Mechanics at Ecole Centrale de Nantes in 1980 with mathematics and control theory minors. Between 1980 and 1984 I have spent 6 months at the CEA, the French Atomic Energy Authority, and have worked as an engineer in the food industry and in civil engineering industry. I worked at INRIA in Paris until 1988, when I moved to INRIA Sophia-Antipolis, close to Nice. During my career I spent a lot of time in Canada and in Japan as a guest researcher and I have a specific relationship with Algeria, where I was born.

My research interests are various but I get involved very early in the analysis of **parallel robots** at a time where the total number of papers that have to be read on the subject was about a dozen. I have devoted much time to a full analysis of this complex closed-loop mechanism, especially on the kinematics side and I am the author of the main textbook on this subject. Nowadays I am revisiting the kinematic analysis of robots that are still parallel robots but are using cables as actuators. Indeed it appears that having actuators that can only pull but not push changes drastically the analysis, a point that has been overlooked by many authors. However, kinematics is not my only field of interest. I started working in **computer vision** and **force-feedback** for robots, hence more on the sensing, control and **geometry** part. But although geometry is a powerful tool that is not not used to its full extent nowadays, it has also some limits when dealing with reality. Hence I have investigated **algebraic geometry**, which plays an important role in kinematics. But here again algebraic geometry has some limits in term of the size of the system it can manage. Because of these drawbacks I got involved in **numerical analysis** and I have investigated **interval analysis**, a mathematical method that allows one to manage large problems including those that are not algebraic. This method has several advantages as it allows one to manage computer round-off errors (indeed, in many cases the calculations of computers are completely wrong) but also to manage **uncertainties**, which are numerous and unavoidable in mechanisms and machines. I have hence used this approach to propose another design methodology, called **appropriate design**, that allows one to determine almost all possible values of the design parameters so that some performance criteria are guaranteed to be fulfilled. Furthermore, this approach is also able to manage differential equations and, therefore, we can deal with **kinetics** or **dynamics** issues. I also believe that **experiments** are essential in our field and I have designed numerous **prototypes** that have also allowed me to identify and better understand theoretical issues. The mathematical approach I have on interval analysis has given me the opportunity to work on **spatial mechanics**, **quantum physics** and **molecular biology** and I do believe that our work on mechanism may have interesting applications in many other scientific fields. Recently I become involved in another aspect of robotics, **assistance robotics** for frail people. In our aging societies developing technologies to ensure the autonomy, mobility, safety and well-being of elderly people is a crucial societal issue. The role of these technologies is not to replace humans by machines but to relieve the helpers from tedious and physically demanding tasks so that they can focus on social relationships with the elderly, which are of the utmost importance for their well-being. Mechanism and machine theory plays a major role in the mobility problem because this is not only a problem of sensors and computers but is mainly the management of a mechanical interaction whose purpose is to avoid fall and/or to provide the necessary

mechanical help for ensuring autonomy.

I also believe that part of our community should get involved in collaboration with industry. For sure we need researchers laying the theoretical groundwork for the future with almost no interaction with current industrial problems ... for now. My favorite example for that is the groundwork of the mathematician Cauchy, who before the 1900's has demonstrated very important theorems for parallel robots. At this time there was no practical applications of these theorems and Cauchy even received strong requests from companies to worry about "real applications". But 200 years later these theorems have allowed us to develop more effective and efficient machines that otherwise would not exist. Although such "blue sky" research is absolutely needed and must be protected, I also believe that dealing with current industrial problems may help developing sound theories and contribute to progress of our field. This explains why I have also collaborated with companies working in the fields of **aeronautics**, **production**, **fine positioning** (developing machines with stringent constraints on the positioning accuracy of the load) to name a few.

In terms of publications, I have written 6 textbooks published by Hermès and Springer, and I am currently one of the head editor of a new Springer collection on parallel robots. I have published over 50 journal papers and 250 conference papers. As dissemination is important to me most of my papers are available in open access, while I maintain 3 large reference databases: robotics, parallel robots and interval analysis. I was Editor or Associate Editor for numerous conferences and Associate Editor for ASME Journal of Mechanisms and Robotics (2008-2011). In 1998 I received an award from the Altran Foundation and in 2000 the "Micron d'Or" Award for the design and construction of a micro-robot for performing endoscopic surgery. In 2014 I became IEEE Fellow and have received in 2015 the title of doctor honoris causae from University Innsbruck.

In summary, my academic background may be summarized with the keywords kinematics, mathematics, control theory, computer science and numerical analysis, experiments and industrial collaboration. Further information on my activities can be found in my web home page:

`http://www-sop.inria.fr/members/Jean-Pierre.Merlet/merlet_eng.html`

1.2 IFToMM

I became involved with IFToMM very early, as my first presentation in a conference was during RoManSy 5, 1984 in Udine, a conference that was organized by IFToMM. I also quickly became involved in other IFToMM conferences such as Advances in Robot Kinematics (ARK) and Computational Kinematics (CK). I joined the Technical Committee on Computational Kinematics in 1990 and I have chaired it for two mandates (1997-2005) and I am still a member of this TC. I am also a member of the Permanent Commission on History (since 2003) and of the Permanent Commission for Communications, Publications and Archiving (since 2010). I was Chair of two Computational Kinematics conferences (1995, 2001), of the IFToMM World Congress (2007) and of IROS (2008) and I will chair the Advances in Robot Kinematics conference in 2016. Between 1999 and 2003 I was Editor in Chief of the IFToMM Electronic Journal on Computational Kinematics. I was Chair of IFToMM France between 2003 and 2010 and I was also involved as Associate Editor for the IFToMM journal Mechanism and Machine Theory (MMT) between 2005 and 2012. I was elected member of IFToMM Executive Council in 2011 and consequently resigned from my role of Chair of IFToMM France and Associate Editor of MMT according to the tradition of EC membership. I also received the IFToMM Award of Merit, the highest distinction of IFToMM, in 2011.

1.3 Motivations for running for IFToMM President

In 2014 I was prepared to run for a second mandate as member of the Executive Council. Indeed I see the Executive Council as a team that jointly organizes the scientific and general policy of the Federation as decided during the General Assembly and implements it during its mandate. I have a vision about IFToMM, as indicated by my long standing involvement in this Federation, but was prepared to serve as a member of the team. For sure I may have considered running for the presidency because of my commitment to the community and because of my vision of the future for IFToMM that need to take strong measures, but in view of the large number of high quality individuals we have in our community I was expecting that several candidates would run for the presidency and I was feeling that we don't need numerous candidates.

My view on the presidency starts changing when meeting or exchanging by email with potential candidates I realize that none of them were running for the presidency. As mentioned previously I have a vision for the future of our Community that is shared by many members of our community. This vision has to be exposed and discussed by the community at the presidential level as the future of the Federation is at stake. A second reason is my view of the role of the Nominating Committee, as stated by our bylaws, to *prepare lists of candidates for election* and *shall seek names of candidates for inclusion in the slate of nominees*. This role is quite clear and induces a clear separation between the candidates and the Nominating Committee. Hence my interpretation of our constitution is that no member of the Nominating Committee may run for a position in the Executive Council unless he/she resigns from the Committee well before the nomination process is completed. I agree that the Constitution is unclear about that point and therefore has to be modified (see my proposal for changes in our Constitution). As we all know a majority of the MO have decided that a new slate of nominees has to presented under the auspices of a new Nominating Committee. After extensive discussions with numerous IFToMM members, it has become apparent that my views on IFToMM shall be presented during the General Assembly and consequently I have decided to run both for the Presidency and for the Executive Council.

2 A vision for IFToMM

2.1 Web and visibility

The current EC has put forward a very decent web page that is maintained by a professional for a fee. Still there are problems with our web as soon as the EC is changing as the web server is hosted by the institution of the President or of a member of the EC. Furthermore the maintenance of the site is done by the professional and therefore we loose our ability to react. Our web includes a lot of information but it is difficult to have a global view, to sort the available data and even to determine who is the contact point for IFToMM (mail, postal address).

Therefore I propose that the EC and the Permanent Commission for Communications:

- look for a sustainable hosting solution for our web so that changes in the EC will not require complex web copies
- look for a web designer that will develop an initial web page. There will be an incurred cost here but it will be only initial as the web should be designed for easy maintenance and updates (see specifications)
- define a canvas for the initial web page (what should be included, for what, for whom, when). Note that in this document there are several proposals of items that should appear in our web: they are indicated in the margin with an arrow. Clearly entry points for contacting the bodies of the Federation (TCs, PCs, Executive Council, ...) should be made available

- propose stringent specifications for these initial pages:
  - access to the file directories should be possible for authorized persons (for example to run a script to verify that all pages of our web are existing and are reachable, a script that I can develop in a few minutes)
  - they should be easily modifiable without having to use a specific web tool (namely the web site should be pure HTML without style sheet)
  - update of some of the pages should be doable by parsing a file. For example the Executive Council pages shall be automatically created from an editable file that contains the necessary information
- uniform pages should be provided for all TCs, PCs that will have the responsibility to maintain them. The current TC/PC pages are mostly constituted of the list of members without any description of the committee activities. I propose to have an activity page(s) that will be managed by the TC/PC and a member page that will be managed by the EC. Here again the list of members will be provided as an editable text file that will be automatically parsed to produce the member page
- encourage member organization (MO) to design their own home page (currently only 12 MO have a web address) and possibly provide a uniform canvas for this page

Our web should be designed to be visible, to provide extensive information on our Federation and be a source of knowledge sharing for engineers, teachers and students at all levels (see sections2.4,2.17). It should also reflect the IFToMM opinion on the future of our domain and on societal problems (see sections 2.10,2.6). Our goal is that members or non members that are looking for mechanical information (whenever finding 3D printing files for building a Bennet linkage or a prospective report on the future of transportation machinery) shall be redirected to the IFToMM site. While the web site should be designed so that its maintenance is performed automatically, it is still unclear for me if having a professional providing help on a regular basis is needed or if we may consider having a specific funding that may be used to hire temporary help for the largest tasks. Efficient and intuitive search tools in our web should also be a priority: I have no doubt that IFToMM members may propose an amazing amount of knowledge but without proper organization and methods this knowledge will only be a clutter. Fortunately some of us have access to teams that are expert in organizing knowledge and we should rely on this expertise to organize our web.

The **visibility** of our Federation should be increased. For example the linkages, mechanisms or machines pages of Wikipedia have no link to the IFToMM page. I propose that the Permanent Commission for Communications investigates pages in Wikipedia related to our domains, update them and systematically links these pages to the IFToMM web site as soon as it is fully functional. But our visibility may also be improved if we move to social networks as many of our members (especially the younger one) use them to get information. Hence I propose that the Executive Council creates Facebook and a Twitter accounts, obtains a YouTube channel and investigates the interest of Pinterest and Slideshare. It should also investigate the necessity of the Federation presence on research-related social network such as ResearchGate and Academia.

2.2 Constitution

Our constitution was drafted in 1969 during the 2nd IFToMM World Congress in Zakopane and was updated from time to time, the latest version being proposed in 2011. But our world has changed so we need to update it on a regular basis in order to put our future forward. Additionally the current constitution also is not very specific about formal issues, potential conflict of interest and procedures (my opinion is that when the

constitution was drafted some rules were so evident that they were not included in the document). Hence the current EC has submitted some possible constitution changes and issues that have to be considered during the 2015 General Assembly. The original version and the proposed changes/issues are presented at

`http://www-sop.inria.fr/members/Jean-Pierre.Merlet/constitution_changes_v1.pdf`

Clearly not all proposals and issues will be solved/discussed during the 2015 General Assembly but it is necessary to move forward on the constitution even between two General Assemblies. Hence I believe that constitution changes may be proposed to the Constitution Committee that will submit them to the chairs of MO for a postal/email ballot (unless the General Assembly will take place in a close vicinity of the decision). If the changes are validated by a majority of MO chairs we will get a provisional Constitution that will be applicable until the next General Assembly that will vote to accept it as our official Constitution.

2.3 Publications

Publication is a major activity of our members. However the current evaluation system pushes our members and institutions to try to increase the number of publications for getting a position, a promotion, a grant, having a better visibility or ranking etc ... with a constant look on **bibliometry indicators** that are assumed to be able to convey the research quality without having to read the papers. Such assumption is preposterous while the real meaning of these indicators is unclear. Furthermore their calculation has been shown to suffer from very significant discrepancies and that they are prone to manipulation at all levels[1]. IFToMM should formally indicate that bibliometry indicators shall be used with circumspection and with a clear understanding of their limitation and certainly not when dealing with domains having different publication rules or audience. Furthermore they may be only one of the numerous tools that should be used for evaluation.

This *publish or perish* syndrome has led to a huge increase of the number of publications that has in turn led to bringing the peer-reviewing process close to the breaking point. IFToMM should be active in a process that will emphasize the necessity of evaluation based on the *quality* of the paper and not on their number. In cooperation with other scientific societies (see section 2.6) IFToMM should convince institutions and governing bodies that rules such as imposing a minimum number of publications for getting a promotion or a PhD have on the long term a very negative impact on the quality. Publishing a journal paper should be, in general, a major event in the career of a researcher and should present significant advances that seldom can be obtained in a year.

Publications are also evolving. Beside classical journal or conference papers we may provide animations, 3D models, experimental data (experiments are often costly and time consuming and their exploitation by a single team is often partial: disposal of raw data may be useful for other teams), software, ... Hence **dissemination** should also be a major preoccupation of IFToMM. As far as publications are concerned in spite of the web phenomena many works are not accessible to the majority, while the journal subscription prices are continuously increasing. A possible solution to increase dissemination is to push IFToMM conference organizer to move toward "open access" in order to increase dissemination and to lower conference fees. However we must be aware that the words "open access" hide many different operating modes. The one favored by commercial publisher is called "gold": papers are free for reading but authors have to pay a paper fee that ranges between 800 and 7500 US $. Another model is the "green" mode where neither the authors nor the readers are submitted to a fee as storage and management cost are sustained by institutions. I believe that IFToMM should clearly indicate that it favors the green open access while leaving the conference organizer to freely choose their publication mode.

[1] see for example `http://www.inria.fr/en/content/download/6425/102503/version/4/file/indicateurv08_english.pdf`

The problem with open access is to propose a sustainable support for strong conference proceedings and other publications. The current web page of IFToMM is not structured to support the maintenance of an open archive. I therefore propose that the EC investigates a sustainable alternative. For example the open archive arXiv, initiated by physicists offers now branches for other domains such as mathematics, Computer Science, Quantitative biology etc .... The EC should investigate if arXiv may be willing to open a "Mechanisms and Machines" branch and what will be the cost for IFToMM.

However current sustainable open archives are not appropriate to support other forms of publications such as 3D data, experimental data etc.. As these forms are quite specific to our domain I believe that the IFToMM Web should be the natural host for such data and the EC should mandate the Permanent Commission for Communications, Publications and Archiving to investigate the possibility of creating a branch of the IFToMM web for that purpose (see section 2.1). web ←

2.4 Education

Teaching is another important part of our job but our way to teach has to take into account changes in the behavior of our audience and modern ways of communicating. The web phenomenon has the advantage to offer to our students a wealth of knowledge (but of variable, sometimes questionable quality), the "know-what", but the drawback of not providing the "know-how" and the "know-why". In the same way computers allow us to avoid having our students spending their time in tedious numerical calculations but we have to teach them the proper "know-how" with computers and make them aware that computers are making calculation errors and that getting a rough mental estimate of the result is always a good idea and part of the "know-why". Budget restrictions in Universities and Schools and the low-cost of computers have led to a trend of learning with computer simulation (although simulation tools have also a cost that is far from being negligible). Simulation provides the know-what and may also be quite efficient regarding the know-why (allowing more easily to replay a sequence of motion at a very slow speed) but it does not provide the practical know-how. However there is nowadays a mean to reconcile simulation and practice by using extensively 3D printing: starting from CAD and simulation it is possible to produce a real mechanism, thereby covering the know what/why/how aspects.

In my opinion IFToMM should become a source of high quality knowledge ("know-what") but also of "know-how" and "know-why".

For that purpose I propose that the Permanent Commission for Education shall be put in charge of determining how knowledge sharing may be organized. Examples of possible means are:

- free models for 3D printing (see for example the open-source 3D models for the Poppy robot `https://www.poppy-project.org`), CAD files ...
- providing shared teaching resources such as tutorials, simulation codes ...
- develop MOOC (Massive Open Online Course)
- test sharing of available hardware resources, investigation of shared development of new hardware

Note that part of these items may be constitute a specific branch of the IFToMM web. web ←

It must be noted that hardware (in the sense of low-cost models, mockups, modular mechanisms, all easy to assemble) may help teachers in our domains but may also be used for providing a lively illustration of theoretical concepts in other domains. Hence I propose that the Permanent Commission for Education shall be in charge of identifying promising hardware and that IFToMM help to constitute **teaching kits**. This teaching kits are basically mechanical hardware that is simple to use and to modify with open-source software and is accompanied by **pedagogical notices** that explain how it may be used to illustrate scientific concepts. In some cases such

kits may be created with the help of IFToMM and it may be interesting to discuss about creating an IFToMM label for them and possibly getting a small royalty for them that may sustain the IFToMM development effort.

I also propose that IFToMM funds **Distinguished Lecturer** positions by selecting each year expert individual(s) that will benefit from the grant to travel, especially to emerging countries, to give lectures in order to favor dissemination. Distinguished lecturers will receive IFToMM teaching kits which they will distribute during their lecture.

An important point for teaching and dissemination is to have common vocabulary and terminology. . The Permanent Commission for the Standardization of Terminology has done a remarkable work to produce the on-line terminology dictionary that is available on the IFToMM web, offering translation between Russian, German, French and English. I propose to expand this initiative to offer a searchable database and also to extend this dictionary to other languages.

2.5 IFToMM conferences

Conferences play a major role in the activities of our Foundation. IFToMM supports conferences in different ways:

- allowing to display the IFToMM logo as a sign of quality
- providing preliminary funding for the organizers. This funding should be, in theory, returned to IFToMM
- providing grants for the Young Delegate Program. These grants allow young researchers to attend conferences and their amount is usually about 500$. Usually a conference get between 1 to 4 of such grants.

With the current scheme IFToMM does not receive any funds from conference, at the opposite of many other scientific societies. I will come back to this issue in the section funding 2.17. Another point is the moderate amount of the grant and the total number of grants that is distributed each year. The current amount allows to register to the conference but does not cover the travel and accommodation costs: this clearly do not favor researchers from some of our MO. The number of grants is also questionable while the age limits (36 years) may be too low: for example a more senior researcher may be willing to move from its current research area toward a domain in our field and may be willing to attend one of our conferences. Hence I propose:

- to create two types of grant for the YDP: *full grant* (for an amount between 1000 and 1500 US $, *partial grant* (at 500 US $)
- to increase the number of YPD grants in a year
- to offer a limited number of grants for a *Senior Delegate Program* whose amount shall be around 500 US $. The attribution of such grant shall be the responsibility of the Executive Council.

The additional funding required to extend the delegate program will be discussed in the funding section 2.17.

2.6 Relation with other scientific societies

Clearly, the topics of our Federation are relevant to many other scientific societies either because they have similar priorities (e.g. ASME) or because some of their activities involve mechanisms and machines (e.g. IEEE). Until now our Federation has no direct official contact with such societies although we may share a lot with

them. I propose that the EC and the TCs establish a list of societies that are relevant to our activity and that afterwards the EC establishes contact with the societies at the highest level with the objective of signing an official general collaboration agreement. The purpose of this agreement may be to

- organize joint conferences (such as the IEEE/ASME Conference on Intelligent Mechatronics)
- write joint prospective and position reports (for example on the use of bibliometry, see section 2.3)
- to offer conference discount for members
- to boost the status of local scientific societies related to MMT, which in turn may lead to obtaining new MO

2.7 IFToMM Awards

Currently IFToMM has two awards namely Award of Merit and Dedicated Service Award. However these awards do not have a great visibility outside of our Federation, especially as our web page does not clearly explain what is the importance of these awards. I therefore propose to have on our web an explanation of the meaning of each award with a separate list of the awardees. I also propose that we provide from now on a short justification for each awardee (e.g. for his/her contribution to ...).

But the smooth running of our Federation is based on the voluntary work of a large number of members. This work should be rewarded by an official recognition of the contribution of these members by IFToMM. Therefore I propose to extend the number of awards distributed by IFToMM. The EC and the Secretary of Honors and Awards Committee will be in charge of determining what new awards may be created together with the award criteria and rules (e.g. a maximum number of award in a given category for each year).

2.8 Women in IFToMM

Clearly women are under-represented in IFToMM with, for example, a single woman in the current Executive Council among the 11 members. For sure our domain is not very popular with women in engineering for societal reasons that go well beyond our Federation. But, for example, it was a woman, Mary Anderson that invented the windshield wiper in 1903 and a recent survey has shown that the application of mechanical engineering in medicine and energy topics is alluring for women. Hence I believe that IFToMM should play an active role to encourage women to join our community. I propose

- that the EC performs an analysis of the current status of woman in our executive bodies, TCs and PCs, MO chairs.
- create a commission, chaired by a woman, that will propose effective measures to have more women in the executive bodies of our Federation, to put forward mechanical engineering to female students and any other measure that may favor the presence of women in our Federation

2.9 IFToMM and the Engineering world

IFToMM is, and shall remain, a **scientific society** with the objectives of gaining and sharing knowledge on the mechanical world. Still our field of study is not only a theoretical one and we have a lot of interaction with the engineering world in which many of our students will end up, that is often a source of problems and ... of funding. Our problem is that our visibility as a Federation in this world is very weak, both for getting and providing information:

- *getting information*: engineers may be aware of the activities of some of our members (but not of all of them) but it is difficult for them to identify which IFToMM individual member(s) or body is the most appropriate to be contacted.
- *providing information*: companies may be willing to hire high-level mechanical engineers with specific knowledge or to propose problems they have difficulties to solve

To address these issues I propose that the EC be put in charge of:

- investigating how to expand our search engine to improve the search results. For example the keyword "parallel robot" should direct the user to the TC on Computational Kinematics and then to members of the TCs that have declared having an activity in this field.
- investigate if IFToMM should have, as many other scientific societies, a generic email address for individuals
- determine if it will be appropriate to create a "job section" on the IFToMM web where companies may provide job announcements web ←
- having an "Open problems" section in our web where companies may propose, even roughly, a specific problem to be solved web ←

2.10 TC, PC and their role, Prospective

TCs and PCs are the motors of our activities, currently mostly by organizing conferences. They are constituted of experts of all the domains that are relevant to our Federation. But there is an issue on how members of these committees/commissions may be nominated and then proposed for validation by the EC. My opinion is that MOs may propose candidates, individuals may propose themselves and TCs/PCs shall also seek for candidates. However the technical expertise of the candidate should always be examined beforehand by the TCs/PCs as it is the major reason for being a member. We have however to consider the case where a candidate is showing significant activity in the TC/PC field (e.g. by attending TC/PC conferences, having published at least one paper in the field, ...) while having not yet reached the expertise required to be a member. I propose to extend the concept of *observer* as defined in our Constitution to those candidates. Having a significant number of observers in a TC/PC will make it easier to have new MOs in the TC and to have new blood in the system especially as the level of activity of our current TCs/PCs is quite variable.

Our Constitution defines quite clearly the role of the TCs/PCs and I do believe that all of them play a significant role for scientific exchanges, dissemination and conference organization. However the constitution stipulates another role namely *to define new directions in research and development within their technical area* i.e. a **prospective** role, in which we are currently somewhat weak. Therefore I propose that:

- each TC/PC should provide to the EC a prospective report just before the World Congress. These reports should include two parts: a current trend part (what is going on, what objectives will be probably reached within the next 4 years, what will be the impact) and a "blue sky" part that will indicate long term and risky objectives. Note that these reports should take into account the financial and geographical constraints that may impose different types of implementation or even will play a major role in the prospective
- we create a **Permanent Commission on Prospective** that will establish after each World Congress an **IFToMM prospective report** that will be an edited version of the TC/PC prospective reports. This

Commission may be composed of each Chair of the TC/PC together with EC members. The difficult role of this commission will be to elaborate an executive summary of the prospective report with the general public as targeted audience. Clearly these reports will have their place on the IFToMM web web ←

2.11 Executive Council

The Executive Council (EC) is the body that insures the day-to-day work of our Federation. Currently the EC has 11 members, that meet at least once a year but also exchanges numerous mails. The duty of the EC members is tough and demanding. Hence I propose to change somewhat the functioning mode of the EC by having an audio-conference meeting roughly once per month. Part of this audio-conference will be devoted to manage the patronage of conferences which involve currently inefficient mails. The size of the EC is also questionable:

- we have roughly 50 countries that are members of our federation: this means that even if all the EC members were changed every 4 years with one member per country, then a given country may have to wait for 16 years to have a member in the EC
- as seen in the previous sections I intend to extend the Federation activities and this will put an additional burden on the EC members

I believe that the EC should be kept relatively small to preserve efficiency and reactivity but also that we may still increase the number of members while preserving the reactivity. Hence I propose that the EC discusses this possibility with a long term plan (e.g. propose to the 2019 General Assembly to extend the number of EC members to 15 and possibly go to 20 in 2023). It will also be needed to discuss the opportunity of having more positions of Vice-President(s) that may relieve the representation job of the President with possibly two Vice-Presidents for an EC of 15 members and three for 20 members.

Clearly the EC should be composed of senior people that have the necessary IFToMM experience. But for gaining experience one must practice and I believe that relatively young researchers must be involved very early in the decision process. For that purpose I propose to create a **Junior Executive Council** (JEC) whose members will be between 30-40 years old. This council will be consulted by the EC on various topics and the EC may decide to delegate the implementation of EC decisions to the JEC. At the opposite the JEC will have the possibility to propose actions to the EC and to report on specific matters. The number of members of the JEC and its structure will be decided by the EC but I believe that the majority of the JEC members citizenship should be different from the citizenship of the EC members in order to allow a maximum of MOs to be represented in the IFToMM councils.

Another problem with the EC functioning is the **follow-on** of decisions. Mail is not the most appropriate tool to follow-on decisions, even with a very strict subject policy (i.e a single subject by mail, that is clearly described in the header). I propose that the EC investigates the use of web-based tools that will allow to follow-on for all decisions of the EC, allowing to detect quickly progress in the implementation of the decision.

2.12 Transparency and Ethics

Our Federation is a democratic one with regular elections and all of its bodies should abide to strict **transparency** rules with a clear policy for managing **conflicts of interest**. As President I will emphasize the necessity of a strict respect of our deontology and ethics. For example we should stress the following rules (without being exhaustive):

- if a discussion in a commission involves an individual or a person/entities related to an individual, then this individual must physically leave the commission room and must no be involved in any matter in the decision process related to this issue. If the members of the commission are not aware of these relations between the discussion and the individual, then is is the duty of the individual to signal his/her conflict of interest

- if a commission is in charge of a decision to which any commission member or any of its relative may have an interest, then the individual must not take part in the discussion and vote if any. If the decision is the major role of the commission, then the individual should resign well before the decision process

Regarding transparency both the Executive Council and the General Assemblies are quite transparent with their minutes displayed on the web. This is less true for the TC/PC and this should be corrected: their web page should display the minutes of their reunions.

As far as ethics is concerned we have seen in the recent past various unethical behavior. They involve a very small minority of researchers but IFToMM should start taking actions on this issue. As an example **plagiarism** has become a major issue for publications. Hence I propose that IFToMM creates a **Permanent Commission on Ethics** that will propose an IFToMM Code of Ethics[2] and a Code of Conduct[3] that will be displayed in our web. This commission should also propose practical measures for dealing with unethical behavior. Regarding plagiarism I suggest that the Commission gets inspired from the IEEE guidelines for handling that matter[4], including actions such as blacklisting. The Commission on Ethics will also be in charge of examining the societal impact of our research: clearly our work may have implications on jobs, may exclude part of the population that have difficulty to adapt to the very fast pace of innovation and cause problems with the respect of privacy and freedom. web ←

2.13 IFToMM permanent address and status

Currently IFToMM has neither a sustainable permanent postal address nor generic contact mail. Any people, companies or scientific societies that want to contact the Federation has to go through the IFToMM web to send an email or a letter to the President or the Secretary General. The current EC has already investigated companies that may provide for a modest fee a permanent address for IFToMM, sending postal mail to the current President or Secretary General (even scanning the letters so that it can be sent by mail). Such company may also offer temporary workplace that may be used, for example, for EC meeting. I propose that the new EC manages this matter and sets a permanent address before the next World Congress.

In the same manner IFToMM has currently no legal status. This raises various issues, especially for financial aspects. For example the Federation cannot receive donation or grant from companies. Even receiving subscription from MO may become a problem as soon as institutions are involved. The current EC has already started studying various statutes of non-for-profit associations in various countries, including taxes and the administrative work that is necessary to create and maintain the association. I propose that the next EC definitely settles this issue and proposes a solution to the MOs. As this issue is crucial it may have to be decided before the next General Assembly and hence I propose that the EC uses a postal ballot in order to get the agreement from the MOs.

[2] see for example `http://www.ieee.org/about/corporate/governance/p7-8.html`

[3] see for example `http://www.ieee.org/about/ieee_code_of_conduct.pdf`

[4] `http://www.ieee.org/publications_standards/publications/rights/plagiarism.html`

2.14 History

I am very sensitive to history at different levels. First we have to construct the history of our Federation. We have the IFToMM Archives located at CISM, Udine, Italy but this facility cannot accommodate all of our data. Indeed in our world many exchanges, decisions are available only through electronic means whose sustainability on the long term cannot be ensured (for example I am not sure that we will be able to read our PDF files in 5 years from now ...). Hence I propose that the Permanent Commission for the History of Mechanism and Machine Science and the Permanent Commission for Communications, Publications and Archiving investigate the possibility of finding an extensible, permanent location for our archives and that all documents regarding EC exchanges be printed each year and also stored on an electronic media, both of them going into the archives.

History of Mechanism and Machine Science is also very important and our Permanent Commission is very active in this field and must be commended. However there is an aspect of history that is currently not well covered: although our domains have a longstanding tradition it may be seen that many researchers are not aware of this past or have difficulty to access this knowledge because of geographical reasons and also because they are looking on knowledge that is available on the web, while many of our older publications may not be available in that way. I propose that

- the Permanent Commission for the History of Mechanism and Machine Science and the Permanent Commission for Communications, Publications and Archiving will continue to identify web resources that provide access to old mechanism and machine publications. These commissions will provide a catalog that will be available in our web. It will be necessary to investigate what resources should be shared or incorporated in the DMGlib initiative[5] and which one will find its place in our Web ← web

- still I believe that many old documents will not be available on the web. Hence I propose to have an "Old publication" link in our web that will provide copies of documents that are not available on-line. For that purpose I propose that the EC send a call to our community at large to identify owners of old publications to scan them for storage in our web. For large documents, such as books, I propose that IFToMM allocates a small budget for using professional scan services ← web

2.15 Relation with Member Organizations (MO)

The quality of the relation between the Executive Council (EC) and the chairs of MO is extremely variable. In some cases it has been almost impossible to communicate with some chairs. Furthermore beside the General Assembly the EC has few direct relations with the MO. In this document I have proposed that the EC has more frequent reunions held by audio-conferences and I believe that this new set of meetings may be an opportunity to deepen the relationship between the EC and the chairs of the MO (or their representative). Hence I propose that a few (possibly 2 or 3) MO chairs may be invited to participate to parts of this EC meeting for a free discussion with the EC. During this meeting they may expose the current state of MMT in their country, what problems, if any, they are encountering, what help may be provided by IFToMM or propose any subject of interest.

2.16 Favoring world dissemination of MMT

A major objective of the measures in this proposal is to favor dissemination of our field all over the world. This is clearly visible in the Education section 2.4 with the proposal of developing affordable teaching kits and

[5] http://www.dmg-lib.org/dmglib

even providing some of them for free and with the Distinguished Lecturer position allowing high-level experts to do teaching in less-favored countries. This objective may also be found in the Conference section 2.5 with the extension of the Delegate Program toward a full funding for conference attendance, while the same spirit exists in the Publication section 2.3 which pushes for a free open-access of our publication, including the oldest one. A richer IFToMM web as described in section 2.1 is also an element for proposing resources that may be sparse in many countries. Extending the number of awards (section 2.7) may also be a mean of encouraging the development of MMT in the less-favored countries while signing formal agreements with other scientific societies, including local ones, may help to improve the local status of these societies (section 2.6).

2.17 IFToMM funding

Currently our Federation gets his funding from the subscription of the MO while the members of the MO get discount on the IFToMM conference fees and from the Young Delegate Program (YDP). To the best of my knowledge no study have never been performed on the balance between MO payment and MO members advantages. I believe that the EC should investigate this issue closely on a regular basis. For that purpose and for the sake of fairness I propose that IFToMM sponsored conferences provides the countries of origin of the people benefiting from the YDP to the EC so that an equitable balance is provided to the MOs. Furthermore in theory IFToMM sponsored conferences should return to IFToMM at least the amount of money that they have received as seed money from IFToMM. To the best of my knowledge not all conferences are returning this money while very few have returned a surplus. This is problematic as we all know that in many cases conferences are beneficial simply because the organizers have to ensure a safety margin for the budget. I am not at all opposed that conference organizers keep part of the surplus in order to cover expenses that are difficult to justify officially but I believe that part of this surplus should be returned to IFToMM and shall be used especially to expend the YDP.

With the current funding scheme our Federation has financial means that are much lower than most of other scientific societies, even of smaller size. I propose that the EC considers various means for increasing our budget:

- conferences: in most scientific societies part of the budget is obtained through conference surplus. We all know that many conferences have a surplus as a result of a careful resource management. I believe that the IFToMM sponsored conferences should return, beside the initial money provided by IFToMM, a small percentage of the surplus (my proposal will be 10% of the surplus). Any IFToMM conference organizer should provide a financial report within 6 months after the conference in order to justify the surplus. The purpose is **not** to push the organizer for making a benefit but to allow IFToMM to expand the Delegate Program that is also beneficial for the organizers
- donation, legacies, foundations: having a legal status will allow IFToMM to get donation and legacies. Furthermore there are many private foundations that may provide funding to IFToMM from time to time. We are not sufficiently active on that point
- individual membership: the previous items may provide some funding for IFToMM but not on a regular basis. I believe that a small individual membership may be the right solution to increase our budget on a more permanent basis. But to be successful individual membership should provide add-ons that are not already available as members of an MO. We have to consider what additional services may be provided to individuals while preserving the principle of our Federation. Possible solutions are:
  - to offer an additional discount to IFToMM conferences for individual member (typically a 10 US $discount)

- to negotiate with other scientific societies to obtain a reciprocity on discount on their conferences and vice-versa
- offering a generic email (e.g. Jean-Pierre.Merlet@iftomm.org)
- providing a professional IFToMM magazine (such as IEEE Spectrum) that will be available for members only
- to gain access to a monitoring tool of scientific literature: currently we may get automatic warning directly from journals with the drawback that many of the papers are not relevant. An automated tool may filter these warning and provide selected information
- to negotiate with Springer and Elsevier, which are our major publishers, to obtain reduced rate to access Scopus, Science Direct, ...

These add-ons (even if some of them are not available or possible) will amply justify a modest membership fee of around 50 US $.

3 Conclusion

The purpose of this document is to explain my view on the future of IFToMM which is well illustrated by its title *Move toward the future but preserve the past*. We have a long history and our Federation is cherishing the works done on MMT by past researchers, although it must be better exploited in our works. For historical reasons our Federation also differs from other scientific societies by putting forward dissemination and facilitating collaboration between countries all over the world: this spirit of the past should be kept. At the same time our world has changed: communication is easier, many new ways of communicating and collaborating have appeared, more knowledge is freely available, new know-hows are existing, including ones that allow for faster development, innovation and fast transfer to our societies. But there are dangers also in this future: privacy may be threatened, private interest may confiscate ideas and goods, evaluation of people, of research are performed only by numbers without bothering about quality, manipulation of communication, of data are becoming quite frequent. Our Federation has to adapt to this *brave new world* or, more exactly, has to propose a vision of MMT that considers and amplifies the benefits of these changes but rejects its negative aspects and effects, according to values that are deeply anchored in our past.

The views expressed in this document are ambitious, perhaps overly so. But they express a long-term vision that, by far, exceed a President mandate. Indeed it implies societal changes which are known to have their own low dynamics and cannot be pushed in the right direction too fast. However my purpose will be to discuss the proposed measures with the MO and the EC, to implement as many of them during the mandate and to have a strict follow-on in order to identify mistakes, what is not working and what may be improved. But a President is only one of the members of the Executive Council team. Whatever is the team that will get elected during the General Assembly I am completely confident that each of its member will be completely devoted to IFToMM. We may have from time to time opinions that differ on specific subjects, leading to possibly heated discussions, but our objective is the same and after settling the issue we will go together to get a friendly dinner (that will not be payed by IFToMM!) and I believe that the presence of a counter-power is an absolute necessity in a democratic federation. Our Federation has strengths (the quality of our research and conferences, the nice relationships between individuals, our will to integrate less-favored countries ...) but it has also weaknesses (lack of visibility, insufficient funding that jeopardize our actions, possibly lack of attractivity for younger researchers, low impact on decisions that affect our research) that must be corrected while respecting the spirit of the Federation: this will be the purpose of my mandate as a president.

4 Annex: summary of proposals

- constitution changes
- improving and expanding our web while simplifying its maintenance and update
- provide uniform web pages for the TC/PC
- encourage MOs to have their own web page
- improve the visibility of IFToMM by using social networks, updating wikipedia
- publish a position paper on publications indicators and emphasize the necessity of looking at quality and not numbers
- encourage our conference organizers and researchers to go to green open-access and organize a mechanism and machine open archive
- offer a storage area for new type of publications (such as experimental data, software, ...)
- provide and organize knowledge sharing for education (MOOC, open-source 3D printer files, tutorials, ...)
- develop and identify open-source teaching kits that may be used by researchers in different domains, not only mechanical one
- funding Distinguished Lecturer position, allowing a few individual to give lecture in less-favored countries and bringing with them teaching kits
- update our terminology dictionary and offer it in other languages while providing a searchable database to consult it
- create a Senior Delegate Program, increase the number of Young Delegate grants while providing either a partial (covering conference fee) or a full grant (covering trip, accommodation and conference costs)
- create a closer collaboration with other scientific societies by organizing joint conferences, writing joint prospective and position reports
- improve the visibility of our Awards and create a limited number of Awards to acknowledge the efforts of our individual members
- increase the number of women involved in IFToMM
- increase our relation with the engineering companies by providing them more information, offering a job section in our web and allowing them to expose open problems
- extend the number of observers in our TC/PC
- having the TC/PC providing a prospective report for the EC every 4 years, that will be collated by a new Permanent Commission on Prospective that will establish an IFToMM prospective report
- increase incrementally the number of members in the EC

- create a Junior Executive Council that will be consulted by the EC and may propose initiatives
- ensure a better follow-on for the decisions of the EC by using modern methods
- have more frequent EC meeting through audio-conference
- improve the transparency of the functioning of IFToMM
- create a new Permanent Commission on Ethics that will propose an IFToMM Code of Ethics and a Code of Conduct. This commission will especially manage plagiarism but also will examine the ethical aspect of our work
- establish a permanent postal address for IFToMM together with the creation of a legal status of our Federation
- improve the archiving of the Federation history, especially by finding a permanent location for our archives
- improve the access to older publications by offering to the community scans of these papers
- invite on a rotating basis a few MO chairs to attend parts of the EC meeting with the purpose of having more contact between the EC and MOs
- increase the financial resources of IFToMM by getting a small percentage of conference surplus and allowing individual membership for a low fee. Individuals may receive additional conference discount, possibly for partner scientific societies conferences, and other possible advantages

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