IFAC Industrial Committee

Workstream D – Responses to initial Qs Nov/Dec 2015

Q1: What is your view about the most appropriate type of event for industry people to attend? See P2 of the attachment to see the types of event that IFAC currently organises: comments on the appropriateness of these are useful, but please add other types of event if you wish.

Russ R: *Perhaps a few industrial folks would find something useful in a conference or workshop presented by academic folks. But, I think only those few in research roles who might be investigating innovative methods. I don't think that academics have much of anything that is relevant to practitioners who need a solution to today's problems. The perspective and values of research are very different from industrial application, and the values of academic pre-commercial funding (related to mathematical prowess and ability to cite the academic literature) are irrelevant to making something work.*

Accordingly, I think the most appropriate type of event is to have topical conferences related to new but proven techniques, that give the audience credible evidence that it works, where it doesn't work, and how to implement it.

Industry publishes when there is a business reason to do so. Rarely would this be to reveal their research progress to the public, unless it has been patented and they are seeking to attract PhDs to join their research team. Usually, publications by practitioners are aimed at selling a skill or product. But, if this were channelled to temper commercialism, I think that industrial marketing incentives could be used to shape presentations that will be attractive to other industrial attendees.

Greg S: First I'd propose that we should avoid thinking of industry as a coherent group comprised of people with similar needs. The motivations and funding sources of an industrial research lab may be quite different from the needs of a business unit who are developing control products and an analogous theory-practice gap exists even within some industrial companies. The motivations of a technologist employed by a vendor of technology may be to advertise and sell his design to the world as opposed to technologists developing a technology to improve the performance of their own products who may instead be incentivized to keep it a secret as a competitive advantage.

I agree that financial incentives for industry to travel and attend are often an inefficient use of conference money. If the conference has good quality content aligned with industry needs *and* contains potential customers of the technology (customers in the general sense including actual end users, funding agencies etc.) then industry participants will attend.

Some conferences have the idea that including an "application" track will address this problem. Many times this only heightens the disconnect. For example in the case where for a given topic all the theoretical presentations are in a single well-coordinated session, and the one practical presentation is two days later in a separate session with 4 other unrelated applications presentations.

Luis B:

Answer: Workshops and Symposiums (rather than world congress) are focus on some specific topics and some of these topics may be relevant or not depending on the type of industry. Probably technological vendors can appreciate the theoretical advances (mostly CC1 and CC2). People from industry will be more interested in novel applications implemented and evaluated in plants (CC6 is a good example).

Andrew A: *Ones that will help them get their job done.*

Carlos P: *My experience is that industry participation can be encouraged by creating ¨industry tracks¨ within the scope of technical conferences. Presentation on industry tracks can be either by invitation (names indicated by a Industry Track Technical Committee) or by a special call for proposals (usually short papers - with 1 or 2 pages - where industry paper can describe the content of their presentations - in order to avoid that the presentation be only a marketing speech). Industries are usually also interested on getting in touch with student attendants of conferences and some job hunting session can also be organized*

Giovanni C: *In my opinion, an effective type of event is an IFAC Symposium or Conference, including one or more dedicated sessions on topics of interest for both industry people and academics, with industry representatives among the organizers and the presenters. Ideally, such dedicated sessions would represent the seeds for follow-up IFAC Workshops targeting both Industry and Academia. It would be good if the potential of a dedicated session for "seeding" a Workshop could be identified at an early stage, for example during the review of the submitted session proposal.*

Philippe G: *From my experience, Symposia and conferences can be well adapted to industrials but not if they stick to the "classical forms", I mean only typical parallel sessions and so on. Workshops are less adapted to my point of view, except on a very specific topic that is of primary interest for an industrial. The difficulty for attending workshop, in my case for example, is that we are not allowed by our hierarchy to attend many events per year, because it is not directly linked to our core activity. Priority is given first to more classical industrial activities. So, if I am allowed to attend only 1 event per year, I prefer to give priority to symposia or conference.*

Coming back to the symposia/conferences: I think the best formula for an industrial is an invited session oriented on industrial applications or on collaborations between industry and academia, e.g. (sorry for taking personal examples, these are the only ones I know well ;-):

- *"Bridging the gap between academia and industry: successful aerospace collaborations", Ph. Goupil, A. Marcos, IFAC World Congress, 2014.*
- *"FDI/FTC for aerospace: from theory to applications", submitted to the upcoming Automatic Control in Aerospace conference, Sherbrooke, Canada.*

There was also a special session on industry/academic cross-fertilization during last Safeprocess in Paris, please see the official report enclosed to this email. I can provide you with more details if needed.

Generally speaking, I personally try to organize this kind of events as I think this is really a good opportunity to bridge the gap between Academia and Industry, and this must be encouraged in such conferences.

Thomas J: *In my Country industry seldom sends its engineers to general conferences, etc. Direct training is preferred. Learning the latest skills to handle complex industry problems: focussed, practical, proven technologies. Sometimes I think that, for industry, we get publication processes the wrong way around: The system is set up to mainly recognise journal publications and conference publications (often dealing with practical implementations and solutions) are often extended to become journal publications that become more academic. Journals become the apex of development and are difficult to translate back into practice. We may consider looking at it the other way around: identify the right industry-relevant journal and conference technologies and turn them into back into practical training sessions. We do have tutorial sessions etc associated with conferences, but these tend to be academic training sessions. I would like to see the loop closed towards identifying industry-relevant articles/technologies that can be converted to industry-relevant training sessions.*

Rogier B: *Part of the mission of the corporate research center of the multinational company that I work for is to push the limits of science and technology for our customers. A strong relationship with the academic community is of high importance to achieve that goal. Scientific conferences are key to keep our researchers abreast of the latest technological developments, but perhaps more importantly, to build relationships with academic groups and national labs to form synergistic collaborations. Larger conferences are generally more attractive given the extended networking opportunity. Topical meetings organized at such conferences focussed at the exchange of vision, ideas and information accompanied with well-led panel discussions can be excellent starting points to initiate and/or accelerate collaborations between academia, national labs and industry.*

It has already been mentioned by other contributors to this discussion, but for the same reason conferences with a predominantly academic character are less interesting than conferences that value contributions with a stronger applied nature.

Silvia M: *Industry people attend an event to :*

1. *Explore new methods that might be relevant for their sector*
2. *See what the competitors are doing*
3. *Networking*
4. *Give a talk as a key speakers or to listen a to speakers closely related to their field*

   In my opinion the more specific and close an event is to the technology sector of interest the more people are encouraged to attend. For example a section on control for power, control for aerospace, etc.

Probably we could identify a few sectors in which we can really make the difference.

About the events per se we could consider two options: include specific sections in the existing conference (I would start from this) and later maybe establishing a specific industrial events with different sections for industrial sectots

At UIUC we initiated (as students, sometime back) a series of symposium for control applications. We invited a significant amount of industry speakers. They were small events, but very specific targeting specific industrial sectors.

http://ieeecss.org/CSM/library/2010/feb10/11-AlternativeEnergyConference.pdf
http://publish.illinois.edu/emerging-topics-2013/

Takashi Y: *I think there are two types of events which engineers in industry may be interested in.*

One is a Workshop where a latest and/or a focused topic is presented and discussed. In this case, most engineers from industry may attend as audience. It might be a good approach to introduce industries to IFAC events. Since control technology covers various fields of engineering, co-sponsors with a specific academy may be valuable. Next is a World Congress or Symposia where engineers from industry could present their outcome. My company recommends younger engineers to get an evaluation from outside such as academia by presenting papers. Thus a certain size of conference may be appropriate. One of my concerns is if presentations from each industry is understandable for engineers in other industries. I imagine technologies applied to actual products or plants must have unique and sophisticated design concepts/methods, but usually it seems not easy for engineers from other industries to understand its uniqueness and details. There are many books, survey papers, and articles describing control technologies applied in industries. But I am not sure if there are many examples communicating among industries to exchange their original methods. It might be interesting to present basic methodology and features of control design from each industry and try to understand its essence. For example, a servo control design for high speed precision positioning may be applicable to chemical plant temperature control, once engineers could understand the context and concept besides just algorithms.

Mike L: *The most appropriate type of event for industry people to attend is probably any event that the industry employer considers to provide some form of return on investment for attendance. A traditional (and perhaps stereotypical view) may suggest workshops as being most appropriate due to the reduced formality (and assumedly an option of non-peer review). Other event formats could also work but may require more effort to make them appealing. Perhaps it is largely about who else is attending, what the content is and importantly attracting a critical mass of either/both to make it a must-attend event series.*

Bran S: *In my 40+ years of mostly industrial experience, there are two primary hurdles in getting industry representatives to attend technical events of any kind:*

(1) It is difficult to secure travel and related funding from their employers for any events that do not have a clear and immediate value for the employer; unfortunately, this means that research-oriented technical conferences, such as all of the ones listed on P2, are not high up on the list of preferred events. Instead, technical trade shows involving the employer's customers and events organized by the employer's technology providers have preference. Even in those cases, funding is hard to get, since travel budgets are pretty tight in recessionary times (such as the current ones)

(2) Most industries are under heavy competitive and market pressures that force a short-term focus (e.g., public companies are typically evaluated by the market based on their results in the most recent quarter). As a result, their technical staff is not encouraged to focus on longer-term objectives of the type that is the subject of most research-based technical events. This is even true for organizations that have some kind of "advanced technology" department. In my experience, there is often a significant disconnect between production teams and such internal "research" groups, such that the latter are perceived as "ivory tower" types who are not particularly relevant to the development teams -- it is an issue of credibility.

So, I am not sure how to answer the question about what is the "most appropriate type of event for industry people to attend", because I am not sure of the intent of the question. From a technical benefit to industry perspective, one would imagine that the type of events that are listed on P2 would be the most appropriate. On the other hand, if the objective is to increase the level of interaction between IFAC and industry, then it might be better for IFAC to be involved in events such as trade shows and technology provider workshops/shows.

Andrés M: *In my experience technical people in Industry benefit much more from smaller, highly dedicated events with a small number of people (about 30/60) and with presence of other industrial participants from the same background.*

Indeed, from my time in Industry, I also saw that it was much easier to convince management to allow attendance and participation when the event was very well aligned technically, and especially if it represented a good PR opportunity (due to high calibre of attendance in terms of main industrial actors and stakeholders, e.g. for space industry participation organization by, or inviting representatives of, the European Space Agency always worked like a charm). In addition, financial coverage for the industrial participant was extremely welcomed but was not always sufficient or indeed necessary. The key driving rationale I felt was "we cannot miss this event as it is organized by ... or the roster has all the people with whom we work or compete in industry".

Thus my suggestion is to try emphasizing and supporting workshops within specific technical areas, and try somehow to do "industrial group" invitations where technical people from different companies working on the same topic are invited, as well as the main government or international agency they work with.

Further, I will suggest (at least in Europe) to take advantage of the final meetings and workshops for the European Commission H2020 funded projects. Typically, there is an open workshop at the end of these projects which if properly supported can be a great opportunity to bring together industry and academic people in that specific topic. If IFAC could set a funding initiative, similar to IEEE CSS outreach but focused on the industrial-academic engagement, it could be potentially more effective than independent organization of IFAC workshops. The funding could cover some of the workshop cost (dissemination, invitation of high-level people external to the project, a joint academia-industry day or half-day under IFAC/EU banner…) and if the initiative is clearly outlined and widely disseminated as a potential complementary funding source it could benefit the community as well as this Pilot Committee goal.

Q2: Does your industry/government body support publishing in journals, via conferences, or both? In the latter case is the PapersOnLine system considered useful for dissemination?

Greg S: *My company supports paper writing. They have a preference for industrial conferences over academic conferences or journals. The more academic publications tend to require the researcher to donate a larger fraction of his/her own time. In many of our businesses Honeywell is a vendor of technology and values our technological reputation. Peer reviewed articles can act as a kind of credibility. Technology "snake oil salesmen" cannot publish in good peer reviewed forums.*

Luis B:

Answer: Yes both, industry usually require a written authorization to take care of confidentiality issues. The main problem seems to be the visibility of IFAC in industry. For underdeveloped countries, theoretical advances are fare away from their contingent technological problems. In my opinion, most academics are solving a kind of imaginary problem, proposing very complex solution to some problems, and they are not taking care of the real constraints usually found in industry problems. I am not judging the value of that but certainly these proposals usually will not be of interest to industry. If one review papers in a IFAC WC, less than 10% will be of real interest for common industries. The problem is that even this less than 10% is not reaching the industrial audience (apart from the minority people from industry attending these events). Probably most people do not know even the existence of POL, an open source of information.

Carlos P: *Government bodies in Brazil usually support publication in journals, but people from industry are not very enthusiastic about journal publications (and even conference publications).*

Giovanni C: *My industry encourages the dissemination of our work and regards it as one of the desired outcomes of research efforts, both by publishing in journals and via conferences. The PapersOnLine system is indeed considered useful for dissemination.*

Philippe G: *My company does not really encourage publication but do not ban it. This is not considered as a priority. We rather focus first on patent registering, if it is worth to do it, and then publication is accepted but not especially encouraged*

We have our own tools for technological surveillance, for finding interesting papers and so on, and we do not consider PapersOnLine, neither IEEExplore and so on…

Thomas J: *Such support is mainly for academia in South Africa. Industry tends to avoid publishing in journals. Maybe its because there aren't really any high impact industrially relevant control journals. Papers are long, very theoretical and not very relevant to industry. I am afraid to suggest creating another journal, so maybe I should suggest creating industry tracks within some journals, such as CEP. More like different types of technical notes, short papers, engineering notes, etc. If done properly, one could improve IFs, readership, shorten review cycles, etc.in the process for the journals. Publishers might like this too. Call these "industrial papers", make them no*

more than 5 pages long and focus on benefits and practical results that have been gained (maybe by using algorithms etc already published in the specific journal). Some of these article types already exist but are seldom employed for publication. AIAA journals e.g. seem to be making use of more of these alternative article types. More readers, more authors, shorter review cycles, more citations, higher IF, etc. Journals chase these things and we could contribute to improving these metrics. Existing journals may be swamped at the moment though…

Roger B: It is absolutely supported. It's not our primary focus as a corporate research center and like in any other corporate organization protection of IP prevails over publishing scientific progress. Nonetheless, for multiple reasons publishing is not just 'tolerated', but actually encouraged or even actively pursued.

To the question if POL is useful: since the far majority of our output is application oriented, we evaluate the right platform on a case by case basis, so I find this question difficult to answer in a general sense.

Silvia M: For us at ABB publishing is encouraged but not mandatory, and typically journals will take more time that we are allowed to dedicate to publications. Yes the POL is a useful system.

Takashi Y: Yes, my company recommends younger engineers to publish papers to major journals so that they could get appropriate evaluations and feedback. In printer and copier industry, as a matter of fact, publishing papers are inactive. In hard disk drive industry, publishing papers used to be very active, because competitors of HDD industry may be optical disk and semiconductor one. Thus HDD industry has had very close collaborations with academia to study pre-competitive technology to compete with other data storage device industries. As a result, not only academia but engineers in industry used to be very eager to publish papers to enhance ones' skills. After many M&As in HDD industry, I am not sure this activity could be kept today. In terms of the PapersOnLine system, it is useful. I suppose industries in early incubation stage and development stage, tend to have strong interests and motivation to join conferences to look for world wide trend of the technology development.

Mike L: Yes, my industry/employer tolerates the publishing of approved content in both journals and conferences.

Bran S: Although I have spent most of my indsutrial career in the embedded/real-time software domain, I do have some experience in the more general cyber-physical systems area (e.g., telecom, aerospace, automotive). During that time, I have been involved with close to a dozen different industrial enterprises from very large ones to small startups. Based on that, my impression is that, in general, industry is not particularly keen on encouraging their staff to publish articles in journals focused primarily on research results. In fact, many of them effectively discourage it, by imposing a stringent corporate IP screening process. The latter is particularly true of larger enterprises, where there is a lot of sensitivity related to IP and potential liability issues. The situation is often markedly different in smaller to medium enterprises, which tend ot be more open and more forward looking since their existence is often dependent on providing technical leadership.

Hence, although the journals and systems such as POL are definitely useful, their readership in industrial circles is relatively constrained and, consequently, their impact is far from what one would desire.

Andrés M: When I was in Industry (a Space company in Spain for 8 years), we certainly liked and used IFAC PapersOnLine system as more often than not access to the ample array of publications out there is prohibitively expensive for most companies.
Since we were active in research and development we did attend routinely the main conferences in our domain and published our results --and thought the widespread dissemination of the publication was positive.

Q3: Is there anything that can be done to provide enhanced industry interest in the IFAC journals (listed on P3 of the attachment), e.g. new titles, methods of working, etc?

Russ R: I was editor in chief of ISA Transactions for about 12 years, starting in 1998, and remain on the advisory board. My aim has been to make the journal bridge the academic-practitioner gap. It is very difficult to do.

I think that academic publications do not provide industry applications folks with the tools or information they need. Academic research journals provide the need to publish pre-commercial research to affirm the value of professors. To publish frequently, the manuscripts have to be about inconsequential tweaks to something. If it were commercializeble, or of strong practical value, then they would pursue patents and licenses, not an academic publication. The pursuit of winning in the Impact Factor game also steers the journal away from meaningful projects that take a long term to bring to fruition. The finding model of academe that funds one professor with enough to support one student doing analysis or simulation (as opposed to funding a team to work on physical systems to generate a real solution) also makes the scope and content irrelevant to industry.

As long as academics serve as editors, reviewers, and managers, I don't think that IFAC journals can appeal to industry. If IFAC decides to rededicate a journal to Control Engineering Practice, then it will get fewer articles, get articles that are really marketing a product or service, and will fall in the IF stature game.

Greg S: *Good comments have already been supplied by Andrés Marcos on this point. Reviewers tend to value theoretical work over applicable theory or applied work. This has the impact of perpetuating the culture of academic work with limited industrial relevance and discourages industrial participation.*

Simply put the content of the journals need to be relevant to industrial users. Consider that one of the most common industrial control problems involves the design of high-performance control for nonlinear plants with model uncertainty – the nonlinearities may include LPV-style parameter variations along with harder nonlinearities such as actuator saturation or hysteresis. While industrially common, the theory supporting this problem is not yet complete such that industrial requirements of stability, robust stability, and performance are achievable for anything except a very limited class of such systems – and even then requiring a very specialized level of expertise. What if the control research community could adopt as a goal to develop development techniques such that these requirements could be addressed by qualified but non-specialist control engineers?

Luis B:

Answer: There are some journals with focus on applications. Some of them explicitly ask for application implemented in real plants (no simulations). May be less emphasis on the maths and more on the economic impact evaluation will be welcome. What are to be gained, incorporating novel ideas to solve a practical problem. More on the kind of problems to be solved previous to implementing a new technological solution, in order to warranty that the benefits will be achieved. More on the robustness of proposals to uncertainties commonly present.

Andrew A: *I think that the journal route is the wrong route. That's of relatively little value to many of the typical industry researchers; although there are exceptions. Industry would rather consume information than present information. It's best to have clusters of information targeted for respective industries. CEP is a good idea but it's very broad.*

Carlos P: *I think one thing that could be done is to have a new journal similar to the IEEE Magazines, with content that are more interesting to industrial people.*

Giovanni C: *Enhanced industry interest in the IFAC journals might be achieved by strengthening the presence of industry representatives in the Editorial Boards. In my opinion, this would help to clearly indicate that proper attention is given to high-quality contributions demonstrating "real-world" impact.*

Philippe G: *I think we have to encourage editorial boards to accept more industrial papers. My experience is that sometimes papers are rejected because reviewers judge that this is not scientific enough or "just an application". What an industrial consider as an innovation is not necessary considered as is by an academic. I had the experience with an Extended Kalman Filter (a modified version) that we have on-boarded on the Airbus A350, which is considered as very innovative for our products. I presented this during a conference and an academic researcher said "where is the innovation ? Kalman filters have been developed many years ago…" and I replied "yes indeed, but there are many industrial constraints making its implementation on a real-time system quite tricky…". So from the paper to plane, sometimes the way is not so simple and I believe it is worth to explain this to academic people, if they want to understand our needs.*

Another appealing possibility: to favour publications on industrial state of practice, for the academia to better understand the industrial context and applications.

I was looking at the CEP Editorial Board: it is mainly composed by academic people, so I think industry involvement must be encouraged also at this level.

Thomas J: *See my answer to Q2 above.*

Rogier B: *In our organization we have broad access to academic journals in general, and within the controls groups this includes good visibility to the IFAC journals as well. No specific comments here.*

Silvia M: *As above for the event, provide publications for specific for industry sector, let's say: control for power electronics, control for marine systems, control for traction systems*

Takashi Y: *As mentioned in Q1, describing basic control design concept and features of the control easily to understand engineers from other industries, may be interesting for industry. Since control engineers are very eager to look for new control design, and it would be very happy to find possibilities to apply control method confirmed in other industries to my controller design. But it is difficult to translate the control design in other industries to the one which could solve my issue. It may be necessary to define some rules for writing the papers.*

Mike L: *Definitely. A new journal could address some important gaps.*

Topic: Engineering problems/challenges

Aim: To publish high-quality problem definitions.

Scope: Problem definitions only (strictly no solutions). Almost every other journal in existence will publish solutions. Permitting solutions will diminish the attention (and space) that should be directed to defining the problem. It is envisaged that a 'Problem definition-based paper' would provide a very thorough depiction of the problem complete with: background, details of typical assumptions and especially details about realistic constraints. Perhaps even outlining the foundation of the ROI ideally in terms of raw non-financial units such as energy/utility consumption, hours, units of product.

Journal quality: Must be peer-reviewed (with input from industry) as the whole point is to provide a place where research output of this nature has value. It would create a vehicle whereby quality problem definitions hold inherent research value on their own. Over time such a journal may be sought after as a quality repository of problems and challenges that researchers could refer to and base their work on.

Market assumptions: There seems to be growing pressure for academics to supplement their existing income with other sources. Non-grant/non-academic funding sources often come with an expectation of tangible/realisable results and economic impact. Hence there is likely to be a growing portion of academics that need to become industry relevant in order to attract funding. Perhaps this market will have the incentive to make their research more industry relevant – the first step of which would be to become familiar with or define the problem of interest in their selected domain.

Why is it needed?:

1. Existing research misalignment: Too much 'applied' research is currently developed against incomplete problem definitions that have only been compiled to the minimum extent that is required to support a researcher's own proposed solution toolkit/method. The bulk of this work is typically of minimal interest to industry as it is not developed against realistic problem definitions and hasn't taken into account the full set of real requirements for the application.

2. High-quality definitive problem definitions are currently (arguably) undervalued. Perhaps there is currently little incentive for academics to invest their limited research time in developing detailed problem definitions as they currently have little academic value on their own. Such a journal would enable researchers to get academic credit for the problem definition work and hence would perhaps be more likely to pursue this as a stand-alone activity. In terms of industry collaboration it moves the pre-commercial-engagement line from before problem definition to after problem definition. Such a journal should gain a respectable impact factor over time as researchers working on solutions would have solid papers on problem definitions with which to reference. Industry is more likely to see and calculate a ROI for collaboration if it is based on rigorous existing problem definition. It is important that the problem definition phase is rigorous, thorough and without contamination or bias due to a researchers favoured toolset or proposed solution.

3. Many journals won't publish problem definitions unless they are accompanied with a solution. This is crazy. Solutions are 'a dime a dozen' as the literature is filled with them. However a high quality definitive problem definition should be of substantial benefit to all researchers in the field as it relieves each of them from undertaking the burden themselves. Hence such papers, if done properly, should end up being highly cited.

4. Current paradigm of solutions looking for problems. A significant portion of academic work seems to eventuate from a 'toolset/solution looking for a problem' mindset. This can lead to superficial/non-realistic problem definitions that are (often subconsciously) tailored to suit the proposed solution. Independently published benchmark comprehensive problem definitions could help to alleviate this.

Why can't this be done within the existing offering of IFAC journals? It is not that it couldn't. It is just that it arguable wouldn't be as effective. It is a subtle but significant paradigm shift.

1. A dedicated journal makes a much higher profile statement of commitment to the direction
2. Such a dedicated journal could get more attention and higher impact factor.
3. Less confusion for reviewers (who are perhaps not used to reviewing papers that don't contain a solution).

Summary

If we want to attract industry to IFAC then (for the applied research that is relevant to industry) we need to keep it real. If it is real then industry people will naturally have an interest and will seek it out at whichever level of event it appears in (workshop, symposium or conference).

A dedicated journal on problem definitions would provide a high profile IFAC outlet for such work. These types of papers often can't be written in isolation from industry. Hence the researcher can justify much deeper work on problem definitions as it would now have academic value in its own right. Indeed it is this issue that is the driving force behind the concept. It also encourages/forces collaboration with industry in order for the researchers to obtain the information. This process itself is also a first step in engagement of

industry people with IFAC. (ie a captive industry audience who then have an incentive to engage with IFAC to see what consequential solution work will appears against their real and relevant problem definition.

Bran S: *In my view, one of the primary issues is a lack of awareness of IFAC among industries that could benefit from interacting with IFAC. A second and closely related problem is that the value proposition for a closer collaboration with IFAC is not obvious. So, what is needed is a concentrated "awareness" campaign, that would increase the visibility of IFAC within relevant industries. This has to include a clear value proposition. To make the latter convincing, it is necessary to collect and publicize as many success stories (i.e., examples of value gained by companies through interactions with IFAC).*

Andrés M: *Journals on the other hand where considered too time consuming and without real benefit, and thus were really a personal effort (and using personal time) of the technical person behind the work. And since, and taking aside the required minimum scholarship excellence of any journal article worth publishing, it was too often the case that the journal reviews will come back with comments along the line "the theory behind the application is quite well known for many years and there are many examples of their application" but that most of those applications were academic examples as opposed to real Space missions or flying commercial aircraft, the process was not the most inducive to spark more interest and effort. Thus, while respecting the necessary quality of a journal publication, efforts should be done in assigning reviewers from Academia with Industrial experience to better judge the merit of the article.*

Q4: What other mechanisms may create enhanced industrial engagement with IFAC?

Russ R: *I like the tutorial session concept that we've implemented in the American Control Conference. It is a 2-hour session. The first hour a person presents a methodology that is relatively new, but has proven practical value. This 3-presentation tutorial is permitted 18 pages in the conference publication. It is not a research presentation showing how advanced the author is, but is to be more like a chapter in a textbook that provides the how to for the audience. This is followed by three presentations from the practice that reveal the application success. The industrial authors can submit a paper for conference acceptance, but they do not need to have a written paper. This removes many of the barriers that prevent industry folks from presenting. It is not presenting research but it is revealing that they are implementing advanced technology and revealing stature. It does not require a paper and all of the internal approvals from legal, marketing, etc. that cannot be done on the schedule of conference paper submission 9-months prior to the event to accommodate review and publication. If the tutorial organizer cannot find three applications (not within academic labs) then the topic is not ready to present to industry. So the message to industry audience is that the technique is credible and that they will leave with how-to knowledge, and the option to have a paperless presentation can attract industry presenters.*

I think this is a good concept, but the academic need to publish and promote research has often led to a corruption of the technique within the ACCs. Many sessions have become glorification of an individual's research followed by former graduate students (who now are in industry) presenting some aspect of their academic research. This has little appeal or credibility to industry. I think it takes strong leadership by a tutorial session chair to reject academic appropriation of the session and to preserve session credibility and utility for industry.

Greg S: *The key issue is that people will participate in something if they believe they will getting value out of it. Fundamentally I think that the challenge is that industrial control problems are only partially addressed by the theoretical work. I completely agree with Michael Lees that the research needs to "keep it real" and industrial participation will follow and not need to be forced.*

I think maybe one of the challenging aspects of working in control in industry is that you have very little control (no pun intended) over the nature of the problems that you encounter. You may run into constraints, nonlinearities, model identification (closed- or open-loop), discrete events, MPC, etc in a fairly unpredictable way and often you have a deadline for delivering results. Since in the course of a typical PhD you may have expertise in only a handful of these topics, so you need to possess the ability to figure out where is the best source material (or people), and start getting up to speed quickly. The technical literature on any one of these topics is often very large and it can be difficult to get started. If there was anything that could be done to facilitate a newcomer to these kinds of topics it could be helpful.

In terms of suggestions, recently I needed to learn about data science, and faced a similar mass of overwhelming information. I discovered a series of Coursera online classes (www.coursera.org) that were very helpful in getting up to speed. I wonder if something along those lines for different control topics targeted towards industry would be sensible? A class in how to approach gain scheduling, or MPC, or model identification – something that shows you the basics, where to get more information, and especially criteria to help determine whether the problem on your desk is a simple or a complex one.

Luis B:

a) Increase visibility. For example, create a newsletter with news oriented to promote IFAC events with topics of real interest for industry (applications cases). Encourage how to participate and how to get access to open material (POL).

b) May be POL needs some reorganization of the material, not only by events, but also the kind of contributions (for example some special access to application papers). Even more, industrial short papers are not considered in the same category of scientific papers and they are not published in POL. It is possible to find some space, may be outside POL (due to index issues), to openly access these contributions?

c) Work with NMO´s. Each country member is different, some of them may need some help to organize dissemination events, or they can help in finding best ways on how to reach the local industrial community and to know better their interests.

d) Do some survey directed to TC chairs to collect information related to industrial participation in the events organized by each TC.

Andrew A: *I think we should broaden our scope a bit. I think trying to change the majority of current academics, and their reward structure, to be more cognizant of the needs of industry will be challenging. Similarly, trying to change industry to value the academic contributions may also be challenging. I think IFAC can lead by starting some new initiatives that bridge interests. In fact, I think we could start in areas that are adjacent to the 'space' of the actual decision algorithms. Suppose we looked at networks and trying to come up with cheaper, more reliable standards for control communications…like open source alternatives to CAN or FlexRay. This would be something of interest and I think we could build a community around this.*

Another community we could build is open source models for certain domains. It's been tried and we've been caught up in debates over which modeling tools are best. If we can get over that and build open source model repositories, that we get together and critique/advance in workshops, I bet we could get some industry folks to be involved. I'm thinking of things like a battery modelling group, a powertrain modelling group, an aircraft modelling group, etc. Things that are domain specific. It could be managed by IFAC and IFAC could control the model repositories…quite a powerful position to be in, I'd say.

Carlos P: *The organization, within the scope of IFAC events, of tutorial sessions and panels with people from industry is in my oppinion a good way to enhance industrial engagement.*

Giovanni C: *I think the idea of launching Webinar series within IFAC that target topics of interest for industrial applications would prove effective.*

Philippe G: *See comments above. Also: organizing more industry-oriented sessions as proposed for the upcoming IFAC WC in Toulouse:*

- *"- application papers presenting research with main focus on concrete contributions to industrial, economical or social fields;*
  - *demonstrator papers exposing some prototype or pedagogical device to be presented at dedicated exhibitions during the congress;*
  - *or history papers relating how the automation and control field has emerged and grown.*
- *Historical, demonstrator and application-oriented invited tracks are most welcome."*

Thomas J: *Industrial invited sessions, more industry representation on TCs, editorial boards, etc. As always: be the change you want to see.*

Rogier B: *IFAC can play a role in creating a stronger industrial engagement by getting to more clarity on the real needs of industry today and tomorrow. In fact, we would also turn this question around, what mechanisms can IFAC create to enhance academic engagement? We observe that the academic controls community produces a body of impressive work of which the relevance and applicability is highly questionable. On the other hand, we are faced with large challenges in the development, deployment and maintenance of control solutions for which the academic community has no answer (yet). What mechanisms can IFAC embrace to better capture these global challenges as well as the larger controls trends? Getting to more clarity is not only beneficial to create enhanced mutual engagement between industry and academia, it will also help to influence government agencies to fund activities that are eventually more impactful for society.*

Silvia M: *3 ingredients:*
1. *Provide a link between the industrial challenging problems and control. Show how control can enable solutions to relevant problems*
2. *Providing training courses for the engineers that will have to operate the systems with new control technology*
3. *In whatever form link control to the specific sector*

Takashi Y: *Much closer communications among industries may be important. Especially, in new industries such as regenerating medicine, designing controller based on not only control theory but also design concept, method, and features of control confirmed in other industries may be useful.*

Mike L: *Potential people to attract to IFAC events:*
1. Target the industry supply chain (this will be industry dependant of course ….) However it is a general concept…. Attract the industry suppliers to attend and give presentations and this may attract downstream industry participants to see what the emerging technologies and plans are from their suppliers.
2. Target people from standards committees: Industries that need to conform/comply with standards may find opportunities to hear presentations and to network with members of the standards development committees to be very appealing.

Bran S: *One possibility is to have special industrial tracks in both conferences and journals that would , at least initially, consist of invited papers from industries with notable technical results. Companies are more likely to view this positively and thus overcome their reluctance to "sacrifice" some of the bandwidth of their technical staff to writing such papers and attending related conferences. (I've been the industrial chair of several technical conferences and this has worked out, although, even with guaranteed acceptance, it is still very hard to get commitments from industry.)*

Andrés M: *See last suggestion in Q1.*

Other comments:

Andrew A: *I think we'll have to change, more so than the industry folks will have to change if this is really something we want.*