

Best Practices for Enhancing Industry Participation in IFAC Events and Technical Committees

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Executive summary

This document is a best-practices guide providing recommendations for engaging more industrial participation in IFAC events and TCS, with the goal of facilitating successful collaborations that benefit all participants.

This document has been prepared by a task force of the IFAC Industry Committee. Comments and suggestions for future versions can be sent to the task force chair, Philippe Goupil, at philippe.goupil@airbus.com.

More material from the Industry Committee, including additional resources to facilitate industry outreach, is available at <https://sites.ifac-control.org/industry>.

1. INTRODUCTION

A survey was conducted in March 2018 among 19 IFAC TCs to compute some statistics about industrial participation within IFAC. (Only TCs that had appointed Vice-Chairs for Industry were included.) 90% of the TCs replied. The mean industrial participation in TCs was 10%, with a standard deviation of 8%. There is strong correlation with the TC topic. TC 6.2, “Mining, Mineral and Metal Processing,” had the highest industrial participation (31%). For TCs with a more theoretical flavor, the number of industrial members is low (e.g., “Large Scale Complex Systems,” TC 5.4). There are some notable TCs without any industrial practitioners, like TC 7.4 on “Transportation Systems,” where industrial interest could be expected.

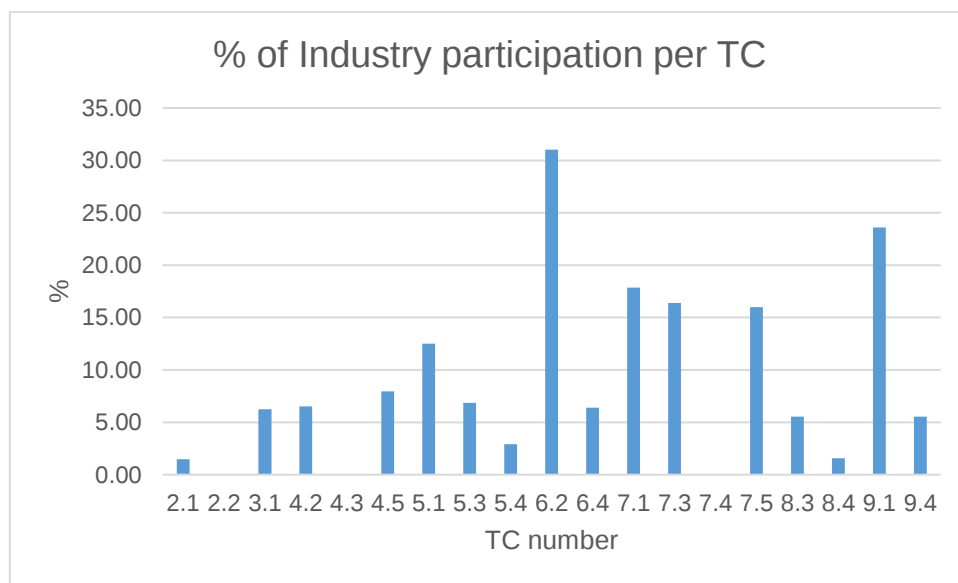


Figure 1 : percentage of Industry members per IFAC TC (03/2018).

A second statistical analysis has been performed to estimate the number of industrial participants in IFAC events (conferences, symposia, and workshops). This investigation covers the period from June 2018 to February 2020. The Covid-19 pandemic situation makes the figures difficult to provide post-March 2020 as all the events have either been cancelled or have turned virtual, at least until close to the time of this report. 71 reports have been analyzed from IFAC events. The average industry participation is 9.8% with a standard deviation equal to 9.3. The maximum value is 41.7% and the minimum is 0. It must be noticed that some reports seem unreliable. For example, a major event gathering several thousands of participants indicated no industrial registration despite industrial sponsors and speakers having been present. A first recommendation to event organizers is to carefully note the number of industrial participants in the post-conference report to be submitted to IFAC, so that consistent reports could be obtained that could, e.g., serve as a metric to monitor the impact of the Industry Committee and the IFAC actions in general to bridge the gap between academia and industry.

A good investigation showing some trends in the past decades can also be found in the article, ["Industry engagement with control research: Perspective and messages", *Annual Reviews in Control*, T. Samad et al., 2020.](#)

These preliminary figures highlight the necessity to involve more industrial practitioners (and the "practical world" in general) in IFAC events and TCs, with the ultimate goal of facilitating successful collaborations that benefit all participants.

This document is organized as followed: sections 2 to 6 deal with guidelines to facilitate industry participation in IFAC events (conferences, workshops, etc.); section 7 is devoted to some guidelines to facilitate the involvement of industry in IFAC TCs.

This guide is a compilation of the experiences and suggestions of the authors who originate from both worlds, academia and industry, with some of them having experiences in both.

2. CONFERENCE/EVENTS ORGANIZATION

2.1 GENERAL ORGANIZATION

For all IFAC conferences seeking to attract industry participation, it is strongly recommended to nominate an IPC Vice-Chair of Industry as a key role in the conference organization and running. This is an important position for attracting industry participation and the conference organizers need to ensure that this role is well recognized and that sufficient means are given to the IPC Vice-Chair to achieve his/her mission (e.g. guarantees, as much as feasible, that the conference program and additional activities are of interest to industry).

It is interesting to note that the IFAC organizers guide already mentions this point and encourages organizers to nominate an IPC Vice-Chair of Industry, noting that "If the IPC Chair is not formally linked to industry, a Vice-Chair drawn from industry or a governmental agency is highly recommended." (<https://www.ifac-control.org/conferences/organizers-guide/organizers-guide>).

As recommendations, the IPC Vice-Chair role could include the following responsibilities:

- Advertise the event in the concerned industrial sectors
- Recommend/contact sponsors
- Encourage industrial participation
- Recommend presentations, papers, sessions, plenary talks, etc. In particular: to solicit, organize and assess special sessions of relevance to industry (e.g. panels, forums, discussion papers, etc.)
- Possibly be part of the paper acceptance review, especially for industrial papers
- Solicit and be part of the evaluation of tutorial sessions of relevance to industry

The examples given below show that it is possible as well to involve both a NOC and an IPC Vice-Chair from Industry. This will help promote the conference in the industrial network of the Vice Chair and to attract industrial attendees.

- Safeprocess 2015 (Paris) included an IPC vice-chair from industry and an industrial financial sponsor (Airbus)
- Advances in Automotive Control 2019 (Orléans) included an NOC Vice-Chair from industry, and an IPC Vice-Chair from industry.
- 18th IFAC Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing (MMM) had both an NOC and IPC Vice-Chair from industry

In addition to Vice-Chair positions, it is also recommended that at least one active industrial practitioner or one IFAC TC industrial member (or an Industry Committee member) should be included in the IPC and/or the NOC. This will also help create connections with potential industrial attendees and sponsors, and with industry in general.

Other organizational recommendations for conferences/events that would help increase industry relevance and participation include the following:

- Industrial days:
 - Observation, context: it is commonly difficult for industrial participants to dedicate a full week to a conference. This could hamper management from authorizing attendance.
 - Recommendation: it is suggested to dedicate one or two days as “Industrial Days,” with reduced fees, and specific industry-oriented events (e.g., competitions, industrial invited sessions, panel sessions, round tables). It is recommended to choose these days in the middle of the week to maximize the mix and meet-up between industry and academia, and to avoid the last days as these are often shorter days where participants start to travel back.
 - Examples:
 - Safeprocess 2015 (Paris), IFAC World Congress 2017 (Toulouse), IFAC World Congress 2020 (Berlin)
 - The European Space Agency (ESA) holds annually a 3-day event of Industry Days that is generally very well attended.
 - The MMM symposium mentioned above had a two-day workshop before the conference. The theme of data-driven analytics and control was industrially oriented.
 - IFAC could also be inspired by ESA practices (see just above) and could try to organize a specific event fully dedicated to industry. Of course, this will then lead to the question of which disciplines to have together, but cross-fertilization is often an eye opener.
- Call for Papers (CfP):
 - IFAC has approved a new type of contribution for its events, termed “Discussion Papers,” that are intended in part to facilitate industry participation. These provide standardized contribution categories and can replace late-breaking result and abstract-only submissions (see below). Discussion papers are typically 1 to 4 pages length and they are not included in the official conference proceedings published in IFAC-PapersOnLine. More information is available in the “IFAC Organizers’ Guide” (referenced above), in the “Publications” section, page 11.

- To encourage Industry participation at the very early stages, e.g., when CfPs are widely distributed, it is advised to provide guidelines defining "industrial papers". To the best of our knowledge, there is no official definition, but a good inspiration is what was called "Late Breaking Results" during the IFAC 2020 World Congress: "Extended abstract contributions, spotlight work in progress, application-oriented to industrial..." For such submissions, a more adapted and flexible reviewing process than the classical one is recommended. Some conferences host special sessions for invited industry papers, which are usually organized by someone who has a good overview of industry innovation and has good contacts. Potential authors are invited to submit a paper (based on some ad-hoc general guidelines). The submitted papers are then reviewed primarily for constructive technical and editorial feedback and the authors are expected to attend the conference and present in the special "industrial" sessions.
- In the same order of ideas, it is recommended to accept "abstract-only submissions," which are ideal for contributions from industry, presenting preliminary results or sharing ideas. To avoid receiving one page with a too general or too advertising content, it is recommended to require, through the CfP and the reviewing process, a minimum of preliminary approach and results. Abstract-only contributions should appear in the conference proceedings and/or preprints. A recent example has been noticed during the 12th UKACC International Conference on Control, 2018, Sheffield, UK.
- Registration: For more accurate data collection, we recommend that conference organizers include a field in the registration form asking for the registrant's organization type. Options can include: Academia, Industry, Government, Retired, and Other. Collecting such information will be helpful when submitting the required event report to the IFAC Secretariat, where industry participation data is explicitly requested.

2.2 SUPPORT AND SPONSORSHIP

As a general introductory remark, the key to getting industrial support and sponsorship is to ensure that company management supports participation of their experts and for that the value that such participation can bring to the company must be clear. This should be an argument to convince industrial companies to become sponsors: beyond public relations and advertising, advantages include networking, exposure to new ideas, cross-fertilization, technological surveillance, competition observation, etc.

Specific benefits that can be offered to industrial sponsors include the following:

- The sponsor can organize a special session of their choice (within the scope of the conference and avoiding a pure public relations event).
- Sponsoring companies can get free registrations for one or more employees (typically employees who are not authors of papers that will be published in the conference proceedings).
- Brochures/flyers of the sponsors can be included in registration packets (physical or electronic).

- Conference bags, pens, etc., could feature the sponsor's name. In the future, the IFAC Conference App (Conference Compass) could also be used to feature sponsors.
- Sponsors' logos and/or brief descriptions could be included on the conference website and in the book of abstracts.
- Sponsors can be recognized during opening and closing remarks or at conference receptions or banquets.

Depending on the size of the conference and the potential for industry interest, different categories of sponsorship can be considered, with different benefits provided, and different financial contributions required, for each. For example, some conferences have three tiers: Gold, Silver, and Bronze.

Legal agreements may be needed in some cases. The nature of these can vary depending on the country and on the conference site (e.g., a hotel, a convention center, or an academic institution). Thus, a standard template is difficult to prepare.

How should potential sponsors be reached out to? Personal connections that the conference organizers have are the best approach. Connections with management-level people or senior technical staff are likely to be more productive than connections with junior staff. Such outreach should not be limited to the NOC Chair or the Industry Vice Chair; all Operating Committee members should help with their contacts.

Conference organizers who are interested in attracting sponsors but are unfamiliar with the process should contact organizers of other conferences on related topics on whose websites sponsors are listed. Past and upcoming IFAC-sponsored events can be browsed at <https://www.ifac-control.org/conferences/@@conference view>.

3. CONFERENCE CONTENT/STRUCTURE

3.1 CLASSICAL/TECHNICAL PROGRAM

For plenary talks and keynote speeches it is advised to invite Industrial executives, provided that they:

- Have a control/automation background, or, if not, they are key/influential persons in a technical domain related to control.
- They are representatives of high-level sponsors of the event (clear guidelines must be defined for the sponsorship to ensure the talk is in line with the conference topic and to maintain the integrity of the event).

The Industry Committee can help identify industry-affiliated keynote speakers on request.

For invited sessions, it is suggested to:

- Organize invited industrial sessions (on specific technical issues, future challenges, etc.)
- Organize mixed academia/industry sessions with a well-balanced participation. 2019 example: "Recent Advances on Anomaly Detection for Industrial

Applications,” 2nd World Congress on Condition Monitoring, 2-5 Dec. 2019, Singapore.

For invited industrial papers: it is recommended to invite an industrial practitioner on a specific topic. This would be similar to a plenary talk but shorter and on a more limited topic.

3.2 SPECIFIC NEW KINDS OF EVENTS

Here is a list of possible new kinds of events that could attract more industrials by representing a more flexible format that is more adapted to industrial practices:

- Encourage industry (or a mix of academia/industry) round tables and panel sessions in addition to classical plenary sessions. Encourage industrial practitioners to talk about the requirements for future control (not necessary to focus on results). Example: “Industry, Academia and Government — Best Practices for Interaction” panel session during the IFAC 2020 World Congress.
- Organize industry tracks: the invited companies have a short slot (e.g. ~10 min) to explain issues or challenges they face in control engineering. Such presentations can offer a good opportunity to academics to check if their expertise matches the companies’ needs. Cf. 12th IFAC Conference on Control Applications in Marine Systems, Robotics, and Vehicles (CAMS) and the 1st IFAC Workshop on Robot Control (WROCO) at KAIST in Daejeon, South Korea.
- Organize industry forums: They can consist of a presentation and discussion by an industry leader. There is typically no published paper in the proceedings, so this means little effort for the industry leader other than showing up. Example: IEEE TEMSCON (Chicago 2018): 45-min presentation by the CTO of Maven, General Motors’ urban mobility company.
- In general, encourage discussions and panel sessions around emerging and hot topics like internet of things (IoT), machine learning, satellite networks, autonomy, etc., where control could play a significant role in the future and where more connections must be established.
- Organize hackathons: inspired by the IT world, these consist of gathering engineers, researchers, and practitioners from different technical fields to solve a given problem in a limited duration. A possible setup is to dedicate the very first day of a conference (e.g., the day of the workshops) and to invite an industrial partner to propose a specific problem. It is clearly not expected to have a complete, operational and validated solution at the end of the day but at least to get a clear view of the global strategy and most of the functional bricks (at least the main ones). A short demonstrator can be proposed.
- Recruitment session (“speed recruiting”): attract Industrials for recruitment. Cf. 2019 IEEE Conf. on Decision and Control (Nice, France) “Meet the Faculty Candidates”: this poster session provided a great opportunity for faculty, search committee members, and industrial recruiters to speak directly with current graduate students and postdoctoral researchers who are seeking faculty positions. Similar sessions can also be organized specifically targeting industry recruitment.

4. BENCHMARK PROBLEMS

A key point for bridging the gap between academia and industry relies on the ability to share specific technical issues that can be addressed through benchmark problems. The benchmark problems can be proposed by industry or by academia. These problems and their solutions can be featured in conferences and they can also be part of a strategy that Technical Committees can adopt to better engage industry.

4.1 BENCHMARK PROBLEM PROPOSALS FROM INDUSTRY

A proposal typically consists of the following steps:

- An industrial participant (the organizer) proposes a public benchmark.
- The benchmark is made available on the conference website.
- The academic (or even industrial) teams who want to compete are invited to download the benchmark and to provide their solution to the organizers in due time. The submission requirements generally include a technical solution (e.g., software) and an accompanying technical note (which could be an extended abstract) or a presentation.
- The organizer proposes an invited session during the conference with the best competing teams.
- The winning team receives an award from the industrial participant during a dedicated ceremony (e.g., at the end of the invited session).

Examples:

- The 2020 IFAC World Congress included 2 industrial competitions:
 - o Aerospace Fault Detection competition: mixed session organized by an industrial company and an academic lab, and dedicated to fault detection in avionics systems. More details here: <https://www.ifac2020.org/program/competitions/aerospace-industrial-fault-detection/>
 - o MathWorks Minidrone Competition: an autonomous car racing competition in the form of qualifying rounds. <https://www.ifac2020.org/program/competitions/mathworks-minidrone-competition/>
- The 2023 IFAC World Congress includes the 2nd Edition of the first of the aforementioned challenges: “Aerospace Industrial Benchmark on Fault Detection and Fault Tolerant Control”. (https://www.ifac2023.org/program/competitions/aerospace_industrial_fault_detection.html)
- Wind turbine Fault Detection and Isolation (FDI) and Fault Tolerant Control (FTC) benchmark and competition: the first benchmark model was proposed during Safeprocess 2009 and was dedicated to FDI only. It was downloadable on the conference website (collaboration between Aalborg University, MathWorks and kk-electronic [now known as KK Wind Solutions]). Two invited sessions were organized to present the submitted solutions and three prizes awarded. This also led to a paper in *IEEE Transactions on Control Systems Technology (TCST)*, 2013. The next step was to enrich the original benchmark with an FTC part. It led to an invited session at IFAC Safeprocess 2012, where the results were announced at the banquet event. Another paper has been published in *TCST* to summarize and compare all contributions. The benchmark has been proposed again during the 2013 American Control Conference, the 2013 IEEE International Conference on

Control Applications and the IFAC WC 2014. This example demonstrates that such a benchmark can be a long-lasting adventure with many publications. The first papers related to the original benchmark are regularly cited and the benchmark continues to be used, with more than 250 citations.

- The Advances in Automotive Control 2016 Benchmark - Look-Ahead Control of Heavy Duty Trucks on Open Roads: the benchmark problem was defined in a collaboration between Linköping University and Scania, dealing with fuel optimal control of trucks on a given road slope profile. A panel discussion was organized in the symposium, and a symbolic prize was awarded by Scania in the venue for the best solution to the benchmark problem. Finally, a joint article in *Control Engineering Practice* gathering all the proposed solutions was published.

Limitations/Risks:

- Industrial participants can be reluctant to provide benchmarks that could potentially contain sensitive information, so the representativeness could be limited as well as the interest for academic researchers (not enough scientific matter for applying recent techniques).
- Benchmarks should normally be communicated and published before the call for papers release for a conference in which solutions to them are intended to be featured.

4.2 BENCHMARK PROBLEM PROPOSALS FROM ACADEMIA

Despite not being common, to the best of our knowledge, the process could typically consist of the following steps:

- Academia proposes a general benchmark problem.
- Industrials are invited to showcase their solutions/products.
- A panel evaluates the proposals according to dedicated criteria.
- The best solution is awarded during a special session.

An example has been proposed by one of the Industry Committee members, in the automotive domain: how to automatically control highway traffic with traffic lights installed at each intersection? The interested industrials would be invited to propose a complete strategy: traffic measurement (sensor technology and installation), data processing, controllers, tests, etc.

Limitations/Risks:

- The topic should be large and flexible enough to attract industrials.
- Companies may respond only to advertise their products and services.

5. ATTRACTING INDUSTRY BY ADVERTISING IFAC

IFAC members are encouraged to meet industrial practitioners during any conferences (not necessarily IFAC conferences, of course) at their exhibition stands to promote IFAC and distribute flyers, brochures, etc., as well as to use social networks, like LinkedIn and Twitter, to advertise IFAC.

IFAC members from industry are encouraged to contact their top management to advertise IFAC activities either directly, if feasible, or for example when releasing conference participation feedback. Also (per section 3.1), inviting industrial executives to give a plenary talk or a keynote speech during an IFAC conference is a very good way to advertise IFAC as the executives may not be aware of IFAC before the invitation. Example: Airbus heads of engineering gave a plenary talk during the World Congress in Toulouse, 2017, which was a unique occasion to make them aware of IFAC, as they were not before.

6. CROSS-FERTILIZATION WITH OTHER COMMUNITIES

Several technology areas currently receive a lot of attention from executive leadership circles, like Industry 4.0, artificial intelligence, IoT, cybersecurity, and quantum computing. The growing interest in these technologies far outpaces that of the control industry sectors. It is thus of primary interest to make connections with these emerging technologies and to show that control can be an enabler and could play a significant role in the industrial application of these emerging technologies.

Referring to the sections above, it could be stimulating to organize invited sessions, plenary talks, panel sessions, benchmarks, etc. on these emerging topics.

7. ENHANCING INDUSTRY PARTICIPATION IN TCS

All TCs whose scope is relevant to industry should appoint a suitable individual as the TC Vice Chair for Industry. This is a critical role for attracting industry participation and pursuing greater industry relevance for a TC. Industry VCs are *ex officio* part of the IFAC Industry Committee and can bring best practices and suggestions that can enhance industry engagement from the committee to their TCs.

All the aforementioned recommendations (sections 2 to 6) should allow a stronger industry involvement in IFAC events and de facto create occasions to encourage industrials to become members of the appropriate TCs.

TCs should consider compiling an inventory of successful collaborations, projects, etc., with industry involvement in their areas of scope to highlight the possible benefits for industrial participation.

It is also highly recommended to create active subgroups in TCs dedicated to industrial applications. These could be oriented toward real-life problems and could encourage the organization of industrial invited sessions or even the set-up of collaborative projects, like European projects under the H2020 program. There are at least the following such TC subgroups existing at the moment:

- TC 6.4 (Fault Detection, Supervision & Safety of Technical Processes-SAFEPROCESS): Working group on "Industrial Application of Advanced FDI/FTC Technology."

- TC 9.1 (Economic, Business and Financial Systems) has 3 working groups related to Industry (“Control Decision/Application in Business,” “Control-Decision/Application in Finance,” and “Control Decision/Application in Economics”).
- TC 3.1 (Computers for Control) comprises one working group on “Industrial Agents”.
- TC5.1. Manufacturing Plant Control, includes two working groups (WG1 IMS and WG3 A-MEST), which are not officially industrial subgroups but are oriented toward applications, namely manufacturing and maintenance.

To attract practitioners to TCs, it is advised to propose more roles (chair, other vice-chairs, etc.) to industrials, not necessarily on a triennial basis due to potential lack of availability, but rather on an annual basis. Limitations: this would mean annual reelection meetings.

Further suggestions include:

1. Promoting industry contributions for nominations for existing IFAC awards.
2. Giving more visibility/prominence to industry achievements for the IFAC Industrial Achievement Award.

8. ACKNOWLEDGMENTS

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