

## IFAC Industry Committee

The need for more and better industry engagement has been a common refrain in the control research community for as long as any of us can remember! Numerous initiatives have been launched toward this goal, but, while we can point to occasional successes, the theory/practice gap in our field continues to yawn wide . . . witness indicators such as the (poor) recognition of the importance of advanced control in industry, industry attendance in control conferences, and the participation of industry representatives in IFAC.

At the 2017 World Congress in Toulouse, IFAC took a major step to redress this problem. An amendment to the IFAC Constitution established a permanent Industry Committee, the objectives of which “include increasing industry participation in and impact from IFAC activities.” The committee is chaired by a new Vice Chair of the Technical Board, who is an *ex officio*, nonvoting member of the IFAC Council. For the 2017-2020 triennium, Tariq Samad was appointed the Industry Committee chair by the Council and thus serves on the TB and IFAC Council. It’s worth noting that the establishment of the committee was preceded by extensive planning. The process started two triennia ago in response to the strategic planning activity undertaken by Ian Craig. A task force was established in 2013, led by Roger Goodall, and a pilot phase of the Industry Committee was operational 2014-17.

### Industry Committee Membership and Structure

The Industry Committee has now been running for over a year and a half. Our membership roster is about 80 strong. The vast majority of the members are currently in or have spent most of their careers in industry, and all sectors with significant control relevance are represented. Members are nominated by IFAC NMOs, Technical Committees, and current committee members.

Five workstreams have been set up and are active, as follows:

- WS1: Industry/academia/government collaboration (Silvia Mastellone [CH], chair)
- WS2: Industry engagement in IFAC TCs and events (Philippe Goupil [FR], chair)
- WS4: Gleaning the “voice of the industry” (Alex van Delft [NL], chair)
- WS5: Educating control engineers for industry roles (Atanas Serbezov [US], chair)
- WS6: Industry Committee communication (Kevin Brooks [ZA], chair)

Another workstream, WS3 on “Industry engagement in IFAC publications,” is currently dormant. However, aspects of publications are covered under other WSs.

An Executive Subcommittee (ExCom) has also been established to oversee the workstreams, manage membership, serve as a liaison to the Technical Board and the Council, and provide general direction to the committee. In addition to the WS chairs, the ExCom roster includes Roger Goodall (UK), Steve Kahne (US), Carlos Eduardo Pereira (BR), and Tariq Samad (US).

### Impact of Control on Industry: A Survey

Newsletter readers may be interested in a survey that the Industry Committee conducted last year, to assess the perception of the impact of advanced control in industry. All committee members were asked to indicate, for each of a number of advanced control technologies, whether they thought the impact was (a) high, across multiple sectors; (b) high, in one sector; (c) medium; (d) low; or (e) none. We also asked for a best-guess future assessment, five years down the road. The results are shown in Table 1.

The top technology is the PID controller, not an advanced control technology (in fact a short-hand definition of advanced control could be “anything other than PID control”!) but included on the list for calibration purposes. System identification, estimation and filtering, and model-predictive control are recognized as having had high impact by about two-thirds of the respondents. Regrettably, some of the crown jewels of control theory—robust control, nonlinear control, adaptive control—are only seen as having had high impact by about a fourth.

*Table 1: Results of a survey by the Industry Committee on the current and future impact of PID and advanced control technologies*

<b>Control Technology</b>	<b>Current Impact</b>		<b>Future Impact</b>	
	<b>% High Impact</b>	<b>% Low/No Impact</b>	<b>% High Impact</b>	<b>% Low/No Impact</b>
<b>PID control</b>	91%	0%	78%	6%
<b>System Identification</b>	65%	5%	72%	5%
<b>Estimation and filtering</b>	64%	11%	63%	3%
<b>Model-predictive control</b>	62%	11%	85%	2%
<b>Process data analytics</b>	51%	15%	70%	8%
<b>Fault detection and identification</b>	48%	17%	78%	8%
<b>Decentralized and/or coordinated control</b>	29%	33%	54%	11%
<b>Robust control</b>	26%	35%	42%	23%
<b>Intelligent control</b>	24%	38%	59%	11%
<b>Nonlinear control</b>	21%	44%	42%	15%
<b>Discrete-event systems</b>	24%	45%	39%	27%
<b>Adaptive control</b>	18%	38%	44%	17%
<b>Repetitive control</b>	12%	74%	17%	51%
<b>Other advanced control technology</b>	11%	64%	25%	39%
<b>Hybrid dynamical systems</b>	11%	68%	33%	33%
<b>Game theory</b>	5%	76%	17%	52%

Additional questions were also asked in the survey. Some notable findings from responses to these queries are as follows:

- Control researchers are broadly unaware of successes of advanced control, especially outside of application domains of their own interest. For example, only about 10% of respondents from the process industries indicated that robust control, adaptive control, and nonlinear control had had high impact, whereas for respondents from aerospace the numbers were 30-35% (still low, of course).
- For successful industry application, domain knowledge, not just control knowledge, is crucial. Real-world applications are industry-specific, and industries differ in their research-to-practice workflows, value chains, safety criticality, etc. Such issues must be understood if research results are to be applied.
- On a related topic, “implementation” aspects cannot be ignored in applied research. These include computational platforms, economic factors, workforce, etc.

A similar survey was also conducted during the pilot phase of the Industry Committee. Results of that survey are discussed on the IFAC blog site at [[need to ask Secretariat for URL]]. An article on the survey was also published in *IEEE Control Systems Magazine* (Feb. 2017).

The Industry Committee is planning additional surveys as well, through its workstreams.

### **Current and Future Activities**

The Industry Committee continues to forge ahead on several fronts. Our primary objectives for the remainder of this triennium are outlined below.

*Collect and promote industry success stories.* As noted above, even within the control research community the practical successes of control are not appreciated. We need to be better at patting ourselves on our collective backs!

*Better connect control with “hot topic” technologies of industry interest.* Control science is a key discipline for furthering the development of emerging technologies such as deep learning, autonomous systems, internet of things, and quantum computing.

*Develop recommendations for IFAC Technical Committees and IFAC events.* A few TCs are reasonably successful at attracting industry participation, including for their conferences and other events, but most of them (including most of the application-oriented TCs) are not. An important goal of the Industry Committee is to help all TCs enhance industry participation in their activities.

*Disseminate the industry perspective to interested control researchers.* Why is industry interested in advanced control? What challenges are faced by control researchers in different industry sectors in commercializing control technology? Every industry sector brings its own requirements and intricacies, including regulatory oversight, commissioning processes, supply and value chains, and modeling and identification methodologies.

*Increase awareness of “innovation” ecosystems.* In addition to targeting positions in academia and established corporations, engineers and scientists are increasingly embarking on entrepreneurial ventures as well. Several control scientists have had notable successes with start-up companies, but many in our community are unaware of opportunities or how best to pursue them.

*Develop recommendations for an industry-relevant first course in control for undergraduate students.* Most engineering undergraduates are not specializing in control, yet they should all be exposed to the

discipline. We are coming up with guidelines for a “first and only” control course (this activity is in collaboration with TC 9.4, Control Education).

*Enhance industry content and relevance for the 2020 IFAC World Congress in Berlin.* This event should provide a good target for some of the first outputs of the Industry Committee. We also encourage submission of industrial invited sessions, industry papers, and open industry benchmark problems from the broader IFAC community.

### **Get Involved**

If you're interested in updates from the Industry Committee, you can befriend us on Facebook (<https://www.facebook.com/IFACIndComm> ) or follow us on Twitter (<https://twitter.com/CommIfac>).

We are also interested in comments from the IFAC community on all matters that fall under the committee's purview. If you know of exciting success stories, or have seen events where control researchers have been rubbing shoulders with practitioners, or have theories to propound to explain the theory/practice divide (and, better yet, how to bridge it), we'd like to hear from you.

Finally, the Industry Committee is always looking for additional members from among IFAC Affiliates who have a strong background in industry.

For all of the above, interested readers can contact the committee chair, Tariq Samad, directly at [tsamad@umn.edu](mailto:tsamad@umn.edu).