Industry Corner – December 2023
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In this issue, we interview Dr. Dimitar Filev. Dr. Filev is a known face to the SMC Society, having served as its president from 2016-2017. Dr. Filev is the recipient of the 2023 IEEE SMCS Joseph G. Wohl Outstanding Career Award, as well as the 2008 IEEE SMCS Norbert Wiener Award. Dr. Filev is a Senior Henry Ford Technical Fellow from the Ford Motor Company (retired) and a Hagler Fellow of the Institute for Advanced Study at the Texas A&M University. Dr. Filev is a Member of the National Academy of Engineering and a Life Fellow of the IEEE. He is also recipient of the 2015 IEEE CIS Fuzzy Pioneer's Award and a 6-time recipient of the Henry Ford Technology Corporate Award, from Ford Motor Company. His research interests are in computational intelligence, artificial intelligence, and intelligent control with applications to vehicle systems, autonomous driving, and automotive engineering. He has over 200 publications with 20,000+ citations, an h-index of 60 and 135 granted US patents.

In this interview, Dr. Filev gives us a glimpse of his amazing career and his leadership roles at SMCS, as well as provides advice to academics interested in industry-academia partnerships and students considering transitioning from academia to industry. Thank you, Dr. Filev, for the words of wisdom. We hope you enjoy this interview!

DR. DIMITAR FILEV, SENIOR HENRY FORD TECHNICAL FELLOW (RETIRED)

1. **Please give us a bit of a background about yourself and your 30-year career at Ford Motor Company.**

My story is about the value of bridging the gap between academia and industry, where research findings seamlessly transition into real-world applications.

I grew up in Bulgaria and moved to Prague, Czech Republic, to pursue my undergraduate education. Prague boasts long and distinguished traditions in engineering, which greatly influenced my decision. I studied Technical Cybernetics at the Czech Technical University in Prague, where I earned my Bachelor's, Master's, and PhD degrees. After that, I worked for 15 years in academia, at the Bulgarian Academy of Science, SUNY Binghamton, NY, and Iona University, NY. During this period, one of my main research interests was modeling & control of biochemical processes. The challenges of applying control technology to biotechnology, which involved dealing with uncertainty and complexity led me to explore the fields of fuzzy logic and soft computing from the perspective of control theory and learning rule-based models from data. This broader view of soft computing was summarized in the book titled "Essentials of Fuzzy Modeling & Control" I co-authored with Ronald Yager in 1994, which focused on the intersection between fuzzy systems, neural networks, machine learning, and control.

In 1994 Lotfi Zadeh recommended me to Ford management as a lead consultant of a mega project on applying fuzzy control to paint process automation in one of the Ford assembly plants in Detroit. This successful implementation was one of the main industrial applications of fuzzy logic at that time, and it marked the beginning of my 28-year journey in industrial R&D. I left the professorship career and joined the Research & Advanced Engineering organization, the innovation arm of Ford Motor Company. There, I had the wonderful opportunity to continue to do research on advanced control, computational intelligence, and AI, and to transfer my research to a wide range of automotive applications, such as advanced manufacturing, human-machine systems, active safety, powertrain control & diagnostics, and autonomous driving. The synergy between research and applied engineering was what propelled my career at Ford from a technical expert to one of the two highest technical positions at Ford - Senior Henry Ford Technical Fellow responsible for the research in Control and AI in the company. Throughout my tenure at Ford, I collaborated with exceptional individuals at Ford, in academia, and within professional societies like the CIS, CSS, ITS, SAE, ACM and of course, SMCS, where I have been actively involved for many years. After my retirement from Ford last year, I was appointed Hagler Fellow at the Institute for Advanced Study at Texas A&M University.

2. **From January 2016 to December 2017, you served as President of the IEEE SMC Society. As most IEEE Societies, the SMCS is trying to better engage with industry partners, especially at our annual conference. Do you have any guidance on how SMCS can best broaden its outreach with industry?**

Establishing strong relationships with industry partners is a vital goal for the IEEE SMC Society, as it can enhance the relevance, impact, and visibility of the society's activities, conferences, and publications. Here are a few suggestions for broadening the society's outreach with industry:

- Invite industry leaders and experts more frequently to participate in the conference as keynote speakers and panelists. This can help to attract more industry attendees, showcase the latest

trends and challenges in the field, and foster dialogue and collaboration between academia and industry.

- Establish and maintain long-term relationships with industry partners beyond the conference. Attract researchers and practitioners from industry, government labs and start-ups to actively participate in the governance of the Society. We can expect that having people from industry as Board of Governors (BoG) members can help to attract more of their peers and expand the membership of the Society towards industrial participation. Traditionally, the SMCS BoG is dominated by academics with one or two outliers. We have tried several times in the past to bring to the BoG people from industry, but it didn't work most of the time.
- Expand the outreach of the Society to the broader engineering community by improving collaboration and partnership with other related professional organizations, e.g., ACM, HFES, SME, and SAE. The existing collaboration with INCOSE can serve as a template for this type of engagement.

3. **Many innovations in e.g., AI and large language models, neurotechnology, electric vehicles and battery design, have been recently driven by corporate research. What would you say are the top-3 emerging areas of technological development being made by industry today? What role do you see SMCS playing in these areas?**

You're right that many recent innovations, like AI, neurotechnology, and electric vehicle technology, have been driven by corporate research. This trend is particularly visible in areas requiring massive investments. SMCS should play a proactive role in identifying and understanding these emerging trends to guide the members of the Society towards impactful research. I envision the need for increasing the leadership role of the BoG in organizing regular (yearly) brainstorming sessions for reviewing the scope of technical committees and adapting conferences and publications to reflect current trends are crucial steps in achieving this.

Regarding the top 3 emerging technologies driven by corporate research, I believe they are:

Artificial Intelligence (AI): AI has a global impact across science, technology, and all industries, from manufacturing and transportation to healthcare, education, finance, and entertainment. The gradient of its impact, especially after the introduction of the generative models, and its potential to revolutionize all sectors of our life make it the top emerging technology.

Sustainable Technologies: The urgent need for sustainable solutions drives significant corporate research efforts in this area. This includes improving energy efficiency across various sectors, precision agriculture for optimized resource use, electric vehicles, increasing the share of renewable energy sources, and potentially, controlled fusion, smart energy grid, and developing and implementing recyclable materials.

Bioscience: Rapid advancements in drug discovery, gene editing, biorobots, synthetic biology, personalized medicine, brain-machine interfaces (BMI), and biotechnology make bioscience another key emerging area for corporate research investments. These advancements hold strong potential for improving human health and well-being.

4. As part of your role at Ford, you collaborated with many universities and academics on research projects. What were some of the key features that made some of these collaborations successful? Any advice you can give SMCS members from academia looking to work with industry on projects and contracts?

Companies are primarily interested in collaborative projects offering tangible results that support their tech strategy within a reasonable timeframe. Therefore, anticipating technology trends and industry needs is crucial for developing competitive proposals. While showcasing research achievements and publications is beneficial, demonstrating the ability of the university team to solve industry-relevant problems holds even greater weight. This includes showcasing willingness to adapt the proposed approach based on industry insights and evolving project requirements.

5. And lastly, many students and young researchers today are considering transitioning from academia to industry. What advice would you offer these young researchers, from the latest technical expertise that is/will be required (e.g., in hardware or programming languages needed) to the non-technical skills sought today by hiring managers?

For young researchers considering a career in industry, acquiring relevant and in-demand technical skills is crucial. For SMCS members, this may include programming in Python, MATLAB, C, C++, basic hardware, and cloud computing knowledge, and so on. Beyond technical expertise, excellent communication skills, teamwork, and adaptability are essential. Management highly values creativity, innovative thinking, and technical leadership skills. Transitioning from academia to industry can be challenging. Be open-minded and don't be discouraged if your initial assignments don't align perfectly with your PhD research or expectations. Consider these experiences opportunities to expand your skillset, gain practical experience, and develop innovative solutions. By tackling challenging engineering problems, you can expect to generate many innovative research ideas. Making the transition from academia to industry can be a rewarding experience. By being persistent, creative, and hardworking, you can land a job that you love and make valuable contributions to the field of engineering.