Advising Philosophy – Z. Spakovszky

My research at the Gas Turbine Laboratory is focused on advanced propulsion systems and turbomachinery with activities in first-principles based modeling, computation, and experiments. The thrust of my work revolves around finding solutions for complex, real world, high relevance technological problems that require novel approaches and a new understanding of fluid flow and its behavior.

Before joining the MIT faculty, I worked at GE Aircraft Engines in Evendale, Ohio as lead engineer in the Engine Preliminary Design and Performance group. My intention was to broaden my industry experience and, more importantly, to gain an inside view of the design practices and strategies governing both competitiveness and the relationship between industry and academia. I observed that, although there is collaboration between industry and academia, there seems to be a natural difference in how knowledge and experience is exchanged and I would summarize it as follows. In "Pasteur's Quadrant", an analysis of knowledge exchange by Stokes, researchers are considered in a matrix with two coordinates: whether or not they place high or low emphasis in the quest for fundamental understanding, or high or low emphasis on considerations of applications. The examples given are Bohr, who sought fundamental understanding without consideration of applications, Edison, who sought applications without a quest for fundamental understanding, and Pasteur whose fundamental contributions were driven by end goal application – hence the title "*Pasteur's quadrant*" on a two-dimensional representation of these perspectives. One of my personal goals has been to encourage and to teach students, researchers and engineers to find their ways into "*Pasteur's Quadrant*". This means acquiring a profound understanding and solid background in the fundamentals as well as stimulating knowledge exchange between industry and academia, potentially enabling new ideas and use-inspired research. In short, my aim is to foster a research and advising environment where the considerations of use evoke the quest for fundamental understanding and scholarship which in turn suggests the applications.

My research group size is typically 6 to 8 students depending on research volume. I meet with my students at least once a week for individual or team meetings where appropriate. I expect my students to come prepared to the meetings so we can discuss progress, challenges, and any potential difficulties. In these meetings, I give guidance going forward and provide help resolving challenges. I like closely working with my students and view collaboration as a full-body contact sport. My aim for second year Masters and PhD students is for them to become the intellectual leaders of the project. All projects involve strong collaboration with the sponsor and my students have the opportunity to engage with engineers and company members through regular phone or webex meetings and also on-site visits (in the US, Europe and Japan). In our monthly webex meetings we report back on research progress and discuss our ideas and technical approaches. These interactions also provide us with feedback and a real-world industry perspective on the problems at hand.

I mentor and advise my students how to write technical papers, project reports, and theses. I give my students the opportunity to attend conferences to present their work and help them become part of the technical community. I encourage my senior graduate students to get involved in the technical and professional societies, for example acting as reviewers or conferences session organizers. My students take on jobs both in industry and academia, sometimes even in finance and consulting. Recent graduates have joined Pratt & Whitney, GE, Rolls-Royce, Airbus, The Aerospace Corporation, Space-X, MathWorks, and Amazon to name a few examples.

In closing, I strongly believe that doing research is much enhanced by instilling passion and enthusiasm for the technological problems at hand. Since I was a child, the smell of unburned hydrocarbons from jet aircraft on the tarmac sent a chill down my spine with the feeling that something exciting and powerful was going to happen. After all these years, this passion has not faded.