Sami El Ferik

Statements of Research

Research Statement

In order to appreciate my contribution to research, an introduction to my diversified preparation is required. As shown in my academic and industrial experiences, I earned a bachelor degree in electrical engineering, a Master's degree and Ph.D. degree in control and automation in computer and electrical engineering. The research project of my master's degree addressed the problem of electrical load modeling and identification to implement a control strategy intended to optimize the electrical power and energy consumption. The quality of my Thesis was the drive behind its recommendation for the best Master's degree thesis in the department. My Ph.D. research was supervised jointly with Mechanical Engineering and addressed the problem of flexible manufacturing systems subject to failure in order to optimize production inventory control. My Ph.D. dissertation was praised by the five members of the thesis committee and was recommended for the best Ph.D. Thesis in the department. My Post-doctoral position dealt with discrete event system modeling and stability analysis. My industrial experience, in R&D department at Pratt and Whitney, was in modeling, control system design and integration, and testing of gas turbine engines. The wide areas of expertise that I possess allowed me to contribute to diverse research projects and collaborate with many faculty members from different department within KFUPM and KAUST. I was successful in initiating research and publishing in ISI journal within the following fields:

- FAST TCP over Optical Burst Switch Network. This research has been conducted at KAUST. Stability of the new generation of communication network was my main contribution. The work has resulted in two journal papers, one of which is submitted to a highly ranked ISI communication and networking journal.

- Control-Loop Performance Monitoring. I supervised two Master's Degree theses in this area with two original contributions that will result three journal papers. The first contribution deals with valve stiction detection and compensation using adaptive inverse models. The second contribution uses genetic algorithm to address oscillation in control loops.

- Drug Administration Control. I supervised two Master's Degree theses in this area and we studied a new approach of controlling insulin-glucose using LMI approach. We are planning on publishing two journal papers from this work.

- Integration of Maintenance and Inventory Control (with Industrial and Systems Engineering Faculty members): I have published seven journal papers in this area. I also have secured funds for a successfully completed funded project. I have presented many

conference papers related to this field of research; and I am presently working on two additional papers, one of which is a solo paper.

- Modeling, Identification, and Control design: In this field, I have published seven journal papers, one of which is in its second revision cycle. I have secured funds for two successfully completed funded projects and a third funded project is under progress. Many conference papers also have been presented.

Furthermore, I have been involved in two funded projects-one at the level of the university and the second one in collaboration with Finance and Marketing Department. In addition, I have been involved in the supervision of seven Master's degree theses and have acted as a member in eight more. I have succeeded to participate in eight funded projects. I have been the principal investigator in four of these projects.

Research interests:

I plan to continue my efforts in sensing, monitoring, and control with strong openness to multidisciplinary research and applications through active collaboration with colleagues and industrial partners. The following are some of the areas in sensing, monitoring, and control that have been identified as areas of industrial importance for local industry partners:

- Sensing:
  - Distributed sensing.
  - Leak detection
  - Corrosion and coke formation.
  - Modeling and identification of certain phenomena within the plant operation.
  - Use of micro-robots in oil wells modeling.
- Monitoring:
  - Wireless sensor network for process monitoring and mobility.
  - Control loop performance monitoring
  - Condition Monitoring and Asset Management (Failure Prediction, Prognostic, Process deviations, Valve stiction)
  - Energy efficiency: Process monitoring and optimization.
- Control:
  - Advance control design.
  - Wireless process control/remote telemetry.
  - Networked Control Systems (Internet Control)
  - Integrate model simulators and process flow diagram generation
  - Integrate Models in Control performance and Tuning.

The joint industry-academy collaboration is the starting point of innovative technology development and research that is of great benefit to KAUST. I also would like to increase my

research contributions in fast network stability analysis, networked control systems, control of drug administration, and stochastic systems modeling and control.