



SAW Symposium 2020 KEYNOTE talk

Harsh Environment Applications of Passive SAW Sensing

Joseph Iannotti

GE Global Research Center, United States

The use of passive RF Sensing utilizing SAW structures has gained great interest in recent years. As GE continues to maximize the efficiency and lifetime of our products in order to provide customers with maximum value, the addition of critical real-time measurements to enhance overall product performance has been paramount. The use of physics-based model control systems provided a great deal of platform benefit and have been deployed for many years enabled mainly by affordable edge computing. These systems use the physical properties of the product along with traditional sensor inputs to model and infer currently unmeasured parts of the product and the inferred values are used along with directly sensed parameters to control the product in an effort to optimize efficiency, power output, lifetime, etc... While physics based model control approaches improve product operation, they do have limitations which are based on the uncertainties within the physics based models. In order to understand final product operating ranges and safety margins, percent tolerance inaccuracies of traditional sensors need to be cascaded through the physics based model along with other model inaccuracies like material properties, part temperatures, gas flow patterns, etc.. The combination of these inaccuracies or unknowns are cascaded through the control model to generate an overall product level control uncertainty. This uncertainty in product capability (lifetime, output power, efficiency, etc.) results in lost capability. It is this "lost capability" that we are trying to regain through the addition of Passive SAW Sensing. Key measurands that GE has identified across multiple product lines include torque, temperature, and strain. Given the vastness of GE products ranging from Wind Towers and Gas /Steam Turbines for power generation to aircraft engines for rotary and fixed wing platforms, GE has identified a large range of product level RF SAW sensing requirements. This talk will discuss the various types of SAW sensing solutions GE has been investigating. The talk will include some of the physical SAW sensing systems that have been built and tested for both performance and endurance, as well as discuss some of the issues and challenges that are often faced in bringing the technology from the lab to the field.