Aalborg University

CAPeX Lectures

Pulsed Power - an Emerging Multidisciplinary Technology for Industrial Applications and Food Processing

Professor Firuz Zare, Queensland University of Technology (QUT), Australia

LINK

DATE AND TIME
February 28, 2025; 9.30-10.30

LOCATION
AAU, Pontoppidanstræde 101, Room 1.001

Abstract: Fast pulsed electric fields have been recognised as an effective non-thermal technique for various applications, including food processing, biotechnology, and waste control. Among these technologies, Nanosecond-Pulsed Electric Field (nsPEF) represents a next-generation advancement that addresses efficiency limitations associated with earlier microsecond PEF models. By reducing pulse durations to nanoseconds—approximately 1000 times shorter than microsecond pulses —nsPEF enhances control over the nonlinear, time-varying, and complex behavior of high-voltage electric fields in various media such as water, juice, and milk. The number of pulses can be further optimised based on the electrochemical, biochemical, and bioelectric responses of the system, enabling tailored solutions for specific applications. Despite its potential, nsPEF technology faces significant challenges. One primary technical barrier is the lack of ultrafast switching technologies capable of generating high-voltage (10–100 kV) pulses with bipolar modulation, adjustable power ratings, and precise parameter control. Recent advancements in power electronics, particularly in semiconductor devices and circuit topologies, offer promising pathways to overcome these challenges and expand the functionality of nsPEF systems.

Biography: Professor Firuz Zare is the Head of the School of Electrical Engineering and Robotics and the University Chair of Gender Equity, Diversity, and Inclusion in STEMM and Research at Queensland University of Technology (QUT) in Australia. Prior to joining QUT in 2021, he served as the Discipline Leader of the Power, Energy, and Control Group at the University of Queensland. Prof. Zare is a Fellow of IEEE, an IEEE Distinguished Lecturer, a Fellow of Engineers Australia, a Chartered Professional Engineer (CPEng), and a member of the National Engineering Register (NER) of Engineers Australia.

He has over 30 years of experience in academia, industry, and international standardization committees, working as a leader, project manager, and senior specialist. This includes eight years at two large R&D centers, where he worked on Grid-Connected Inverters, Energy Conversion Systems, and Power Quality Projects. Prof. Zare has extensive experience in team building, management, and leadership across emerging and multidisciplinary research and teaching activities, cross-institutional research and technology projects, and national and international standardization committees. He has been an active member of the International Electrotechnical Commission (IEC), as well as Danish and Australian standardization committees since 2013. He also served as a Task Force Leader (International Project Manager) for Active Infeed Converters, leading the development of the first international standard, IEC 61000-3-16, within the IEC SC77A standardization committee. Prof. Zare has received numerous awards, including an Australian Future Fellowship, the John Madsen Medal, a Symposium Fellowship, and an Early Career Excellence Research Award, along with several paper and service awards. Prof. Zare has published over 340 peer-reviewed conference and journal papers and technical reports.

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