Solid-state Pulsed Power and Civil Applications

Abstract:
The course will focus on fundamental concepts for repetitive high-voltage pulse generation using state-of-the-art power semiconductor technology. This includes the most common power semiconductors devices used in solid-state-based high-voltage modulators, characteristics and practical operation, and the most widespread semiconductor-based HV pulse modulator topologies, advantages and limitations, such as the classic Marx generator and voltage multiplier circuits. In addition, future trends on this technology are overviewed. Finally, examples of industrial applications will be discussed, as well as, other aspects related to the type of load requirements these applications present to the high-voltage modulators.

Outline:
- Pulsed-Power fundamentals
- Industrial applications
- Pulse requirements
- Energy storage
- Switching - semiconductors and magnetic switch
- Opening switch, inductive storage
- Closing switch, capacitive storage
- Topologies/techniques for pulse generation
- Protection, Triggering, thermal considerations
- How to deal with limitations /stacks
- The load types (R, L, C)
- Future trends
- Summary

Intended audience:
The topics in this course are directed toward graduate students, scientists and engineers, and managers who want to learn from the experimental and design point of view the peculiarities of modern solid-state pulsed power and applications.

About the instructor:
Dr. Luis Redondo was born in Lisbon, Portugal in 1968. He received the B.Sc. and Dipl. Ing. degrees in electrical engineering from the Lisbon Engineering Superior Institute, ISEL, Portugal, in 1990 and 1992, the M.Sc. degree in nuclear physics from the faculty of Sciences from the Lisbon University, FCUL, Portugal in 1996, and the Doctor degree in electrical and computer engineering in 2004, from Technical Superior Institute from the Lisbon Technical University, Portugal. He is currently Coordinator Professor at ISEL, teaching Power Electronics and Digital Systems. His current research interests include pulsed power systems for industrial applications. Prof. Redondo is a member of the Portuguese Engineering Society and member of the Pulsed Power Science & Technology Standing Technical Committee of the Nuclear & Plasma Science Society of IEEE, where he was appointed Distinguished Lecturer. Professor Redondo has contributed to 5 Portuguese Patents and 60 international peer-review papers.