ITEE PhD – Ad hoc Course Announcement

Università degli Studi di Napoli Federico II

PhD Programme in Information Technology and Electrical Engineering

http://itee.dieti.unina.it

Module Title: Distributed Photovoltaic systems

Lecturer: Prof. Carlo Petrarca

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BIO: Carlo Petrarca was born in Caserta (Italy) in 1967. He is presently Associate Professor of Electrical Engineering at the Department of Electrical Engineering and Information Technology, University of Naples FEDERICO II, teaching courses on basic circuit theory and characterization and modelling of materials for electrical engineering.
His research interests include high voltage testing and modelling, non-destructive testing of components, electromagnetic characterization and treatment of innovative materials, lightning effects on power systems, complex networks analysis.

Lecturer: Dr. Marco Balato

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BIO: Marco Balato was born in Napoli (Italy) in 1984. He received the Master degree in electronic engineering and the Ph.D. degree in Energy Conversion from the Second University of Naples "SUN", Italy, in 2011 and 2014, respectively. He is currently working, as Assistance Professor, in the Department of Electrical and Information Technologies of University of Naples Federico II. His main research interests are in power electronics, modeling, and control techniques for energy conversion systems from renewable sources.

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Dates and venues (rooms are in DIETI Building 3/A, via Claudio 21, Napoli) (to be confirmed)

Date	Hours	Room	Lecturer
TBD		To be confirmed	C. Petrarca/M. Balato
TBD		To be confirmed	C. Petrarca/M. Balato
TBD		To be confirmed	C. Petrarca/M. Balato
TBD		To be confirmed	C. Petrarca/M. Balato
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ECTS Credits: 4

Overview

PhotoVoltaic (PV) sources are among the most interesting renewable sources for the scientific community in particular and at large. Due to PV modules' poor efficiency, in the last 35 years, research efforts have been predominantly spent on the energy issue; maximization of the energy produced from PV systems during their useful life has been the main goal—a goal that, in uniform atmospheric conditions, may be achieved by forcing the PV system to work in the maximum power point (MPP). The continuous tracking of the MPP, through the action of so-called maximum power point tracking (MPPT) control techniques, allows us to achieve a double objective: the maximization of the power extracted and the reduction of thermal stresses. Unfortunately, when PV systems work in mismatching operating conditions (due to shadows of neighboring objects, dirtiness, clouds, manufacturing tolerances, dust, thermal gradients, uneven aging, etc.), the maximization of the power extracted and the reduction of thermal stresses are contrasting requirements. In these conditions, the localized heating phenomena due to bypass diode conduction and/or to reverse biased PV cells unavoidably speed up the PV modules' degradation mechanisms, causing a reduction in their reliability. Therefore, proper control of the PV system's operating point and/or of PV modules' electrical connections, with the aim to avoid or to limit localized heating phenomena, can be beneficial to maximize the energy production of the PV system itself during its lifetime. In PV applications, a new challenge is based on the following idea: "the maximization of the extracted power, when it is obtained at the price of too severe thermal stresses, is to be avoided". It may be preferable to give up part of the available energy today to gain a greater amount of energy tomorrow. The topic of this course is not only to treat the most common used MPPT techniques but also to introduce future challenges in PV applications.

At the end of this course all students will have to demonstrate a mastery of the main MPPT techniques. The verification procedure consists in a laboratory experience in which all students will have to implement one of the MPPT techniques faced during the course.

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Content

Lesson 1 – Topic 1: Introduction to the PhotoVoltaic (PV) systems.

Lesson 2 – Topic 2: Overview of Maximum Power Point Tracking (MPPT) techniques.

Lesson 3 – Topic 3: The negative effects associated to mismatching operating conditions.

Lesson 4 – Topic 6: Distributed MPPT (DMPPT) techniques.

Lesson 5 – Topic 6: Dynamical Reconfiguration techniques.

Lesson 6 – Topic 6: Overview of PV module faults.

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