POLITECNICO DI MILANO

PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 38th cycle

THEMATIC Research Field: SWITCHING AND PROTECTION IN LOW VOLTAGE DIRECT CURRENT SYSTEMS

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Low voltage direct current systems are interesting for many different applications, including generic power distribution in industry and buildings, transportation (traction systems, aircraft and ships), and small networks such as data centres and microgrids. The research has the purpose to outline the possible system architectures for LVDC power distribution, keeping into account: - the growing presence of electronic equipment and other DC-powered loads; - the use of solid state converters to switch between voltage levels; - the presence of solid state generators (typically PV) in close proximity to the loads; - the possibility to install battery or supercap-based storage systems in close proximity to the loads. The main objective of the research is to examine the options for system architectures. based on the existing architectures, and on their foreseeable evolution, the following aspects will be considered: - criteria for the choice of voltage levels; - type of distribution system (number of conductors, usage of the neutral, etc.); - grounding criteria; - consequences of the co-existence, in the same installation, of DC and AC sections, with different voltage levels and with different grounding, and criteria for their interconnections.

	For viable architectures, the research will follow considering the possible faults and of their effects. In particular, transient and steady-state fault currents will be considered. Based on this study, proper strategies for fault detection and interruption, and criteria for the design and operation of protection and seitching devices, will be outlined.
Methods and techniques that will be developed and used to carry out the research	Starting from analysis of standard and common engineering practices, system modeling through modern methods based on mathematical tools and programming will be carried out. Some foreseeable applications for DC power distribution will be identified and typical system architectures will be devised. Lab activities for model validation and characterization will be carried out.
Educational objectives	Prepare researchers with high scientific qualification, autonomous research ability in the Power System area: this includes specific skills in modelling of both technical and economic issues, simulations, critical analysis and validation of results. Moreover, cooperation in real life projects will be supported in order to develop tools and studies directly applicable on field.
Job opportunities	The main opportunities are offered, typically, by R&D departments of small and large technology companies and manufacturers, research centres, Transmission and Distribution Operators, Regulating authorities, Generation Companies.
Composition of the research group	5 Full Professors 4 Associated Professors 3 Assistant Professors 15 PhD Students
Name of the research directors	Roberto Sebastiano Faranda

Contacts
Email: roberto.faranda@polimi.it Tel +39 02 2399-3793 https://www.energia.polimi.it/en/energy-department/laboratories/research-laboratories/photovoltaicpower-quality-and-lighting-system/ Link to web page of the research group:

https://www.energia.polimi.it/en/energy-department/research/research-groups/electric-power-systems-group/#c1812

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. This amount is equal to 10% of the annual gross amount, for 3 years.

Teaching assistantship: Availability of funding in recognition of supporting teaching activities by the PhD student. Thereare various forms of financial aid for activities of support to the teaching practice. The PhDstudent is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: individual use.

Desk availability: individual use.

Accommodation in Politecnico's Residences (http://www.residenze.polimi.it) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application).

Research period abroad: Our candidates are strongly encouraged (6 months minimum is mandatory) to spend a research period abroad, joining high-level, research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months.