DAUSY

Research theme title:
Modelling, control and optimisation of electrical smart grids

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Description:
This Ph.D. research project aims at the study, design and development of nonlinear control and optimization strategies, possibly coupled with AI/Machine Learning techniques, aimed at power management of electrical smart grids. The smart grids, comprising of multiple agents acting as power sources and/or loads, will be modeled according to the framework of switched and hybrid dynamical systems. Control algorithms will be designed to regulate the power flow both on the local level of the single agent and on the hierarchically higher level to allow the implementation of desired power management policies. A possible applicative scenario is that of the so-called "More Electric Aircraft", that aims at traditional aircraft electrification through replacement of hydraulic and pneumatic devices with their electric counterpart. The increased number of electric and electronic devices onboard calls for the need of automated control algorithms aimed at achieving specific power management policies. Hence, innovative, possibly optimal, power management algorithms need to be implemented to contemporarily guarantee the achievement of the control goal and the safety of the aircraft micro grid.

References:

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[2] Y. Shtessel, C. Edwards, L. Fridman, A. Levant, "Sliding Mode Control and Observation". Birkhäuser New York, NY, 2014.
[3] A. Cavallo, G. Canciello, and A. Russo, "Integrated supervised adaptive control for the more electric aircraft," Automatica, vol. 117, p. 108956, 2020.
[4] G. Canciello, A. Cavallo, A. L. Schiavo and A. Russo, "Multi-objective adaptive sliding manifold control for More Electric Aircraft", ISA Transactions, vol. 107, p. 316-328.
[5] A. Russo, G. P. Incremona and A. Cavallo, "Higher-Order Sliding Mode design with Bounded Integral Control generation," Automatica, vol. 143, p. 110430, 2022.
[6] A. Russo, G. Paolo Incremona, A. Cavallo and P. Colaneri, "State Dependent Switching Control of Affine Linear Systems with Dwell Time: Application to Power Converters," 2022 American Control Conference (ACC), Atlanta, GA, USA, 2022, pp. 3807-3813,
[7] A. Russo and A. Cavallo, "Supercapacitor stability and control for More Electric Aircraft application," 2020 European Control Conference (ECC), St. Petersburg, Russia, 2020, pp. 1909-1914,

Specific Information:
Applicants must hold a master's degree, preferably in Engineering, with a solid background in mathematics and relevant areas of interest (i.e. nonlinear control, optimal control, power systems). Solid coding skills are encouraged. Proficiency in both spoken and written English is required. The candidate should be highly motivated and interested in undertaking innovative and challenging research activities involving both theoretical analysis and experimental validation.

Type of scholarship:
DM 118/2023 – Project on PNRR (Italy's Recovery and Resilience Plan)