Publicacions més rellevants de la línia de recerca:
Control Avançat de Sistemes d'Energia

Referència: Batlle, C., Dòria, A. and Ortega, R. Power flow control of a doubly-fed induction machine coupled to a flywheel. *European Journal of Control*, **11(3)** (2005), pp. 209–221.

Abstract: We consider a doubly-fed induction machine controlled through the rotor voltage and connected to a variable local load that acts as an energy-switching device between a local prime mover (a flywheel) and the electrical power network. The control objective is to optimally regulate the power flow, and this is achieved by commuting between different steady-state regimes. We first show that the zero dynamics of the system is only marginally stable; thus, complicating its control via feedback linearization. Instead, we apply the energy-based Interconnection and Damping Assignment Passivity-Based Control technique that does not require stable invertibility. It is shown that the partial differential equation that appears in this method can be circumvented by fixing the desired closed-loop total energy and adding new terms to the interconnection structure. Furthermore, to obtain a globally defined control law we introduce a state-dependent damping term that has the nice interpretation of effectively decoupling the electrical and mechanical parts of the system. This results in a globally convergent controller parameterized by two degrees of freedom, which can be used to implement the power management policy. The controller is simulated and shown to work satisfactorily for various realistic load changes.

Referència: Batlle, C., Dòria, A. and Fossas, E. Bidirectional power flow control of a power converter using passive Hamiltonian techniques. *International Journal of Circuit Theory and Applications*, **36(7)** (2008), pp. 769–788.

Abstract: A controller able to achieve bidirectional power flow for a boost-like full-bridge rectifier is presented. It is shown that no single output yields a stable zero dynamics for power flowing both ways. The controller is computed using port Hamiltonian passivity techniques for a suitable generalized state space averaging truncation of the system, which transforms the control objectives, namely specified output mean value of the voltage dc-bus and unity input power factor in the ac side, into a regulation problem. Simulation and experimental results for the full system confirm

the correctness of the simplifications introduced to obtain the controller.

Referència: Batlle, C., Dòria, A., Espinosa, G., and Ortega, R. Simultaneous interconnection and damping assignment passivity-based control: the induction machine case study. *International Journal of Control*, **82(2)** (2009), pp. 241–255.

Abstract: We argue in this article that the standard two-stage procedure used in interconnection and damping assignment passivity-based control (IDA-PBC) consisting of splitting the control action into the sum of energy-shaping and damping injection terms is not without loss of generality, and effectively reduces the set of systems that can be stabilised with IDA-PBC. To overcome this problem we carry out, simultaneously, both stages and refer to this variation of the method as SIDA-PBC. To illustrate the application of SIDA-PBC we consider the practically important example given by the control problem of the induction machine. First, we show that torque and rotor flux regulation of the induction motor cannot be solved with two stage IDA-PBC. It is, however, solvable with SIDA-PBC. Second, we prove that with SIDA-PBC we can shape the total energy of the full (electrical and mechanical) dynamics of a doubly-fed induction generator used in power flow regulation tasks, while with two stage IDA-PBC only the electrical energy can be shaped. Simulation results of these examples are presented to illustrate the performance improvement obtained with SIDA-PBC.