MODELLING OF DYNAMICAL SYSTEMS ON NETWORKS AS PORT-HAMILTONIAN SYSTEMS

IVICA NAKIĆ (ZAGREB)

Port-Hamiltonian systems are a special kind of differential-algebraic equations, similar to those introduced in [1, Lecture 10], which are endowed with a special mathematical structure. In the port-Hamiltonian systems theory the physical system is seen as an interconnection of simple subsystems, mutually influencing each other via energy flow, hence this framework is suitable for modelling and analysis of multi-physics systems.
The dynamical systems on networks are dynamical systems consisting of simpler sub-systems mutually linked in a network-like fashion where the dynamics arises as a compound effect of the interaction between sub-systems.
The first goal of the project is to introduce the relevant terminology of the port-Hamiltonian systems theory including the so-called Dirac structure. The second goal is to examine how this framework can be used to model and analyse dynamical systems on networks. The main source is [2].

This project is suited for 3 to 4 students.

References

[1] ISem 23 Lecture Notes, 2020.
[2] Van Der Schaft, A. J., and B. M. Maschke. "Port-Hamiltonian systems on graphs." *SIAM Journal on Control and Optimization* 51.2 (2013): 906-937.
[3] Jacob, Birgit, and Hans J. Zwart. Linear port-Hamiltonian systems on infinite-dimensional spaces. Vol. 223. Springer Science & Business Media, (2012).
[4] Van der Schaft, A. J. "Port-Hamiltonian differential-algebraic systems." *Surveys in Differential-Algebraic Equations I.* Springer, Berlin, Heidelberg (2013): 173-226.