In this talk, we present passivity-based perspectives for distributed optimization. In the former half, we address a class of distributed optimization problems, and design a distributed algorithm based on so-called PI consensus algorithm. The dynamical system is then shown to be regarded as a feedback interconnection of passive systems and hence to preserve passivity. As a benefit of the passivity-based perspective, we then integrate inter-agent communication delays using passivity-based output synchronization techniques together with so-called scattering transformation. The presented solutions are then applied to a 3D human localization problem for a camera network and demonstrate their effectiveness.

In the later half, we address HVAC (Heating, Ventilation and Air Conditioning) system optimization and control for buildings, and present an integrated design procedure of optimization and physical dynamics. After formulating a building thermal dynamics and an associated optimization problem, we design an optimization dynamics based on so-called primal-dual algorithm, and prove its passivity. We then design a local controller to control physical dynamics, and prove its passivity. Based on these passivity results, we interconnect the optimization and physical dynamics, and prove convergence of the room temperatures to the optimal ones. We then consider the case with multiple buildings, and present a three-layer distributed optimal control architecture.

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