Modeling and Approximation for Control and Optimization of Thermal Fluid Systems

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Abstract

In this presentation we discuss modeling and computational issues that arise in control and optimization problems for thermal-fluid systems. The problems are motivated by applications to aircraft environmental control systems (ECS), thermal management systems (TMS) and heating, ventilation, and air conditioning (HVAC) systems. We focus on heat exchangers which are the basic components in thermal management systems and discuss the impact that actuator dynamics can have on modeling, numerical approximations and control design. The problems are formulated as abstract boundary control problems and distributed parameter control theory is used to guide approximation and model reduction schemes. A combined finite element - finte volume scheme is employed to develop numerical models that preserve dual convergence needed for optimization and optimal control. We present examples to highlight technical issues that occur when dealing with the composite systems that occur when actuator dynamics are included as part of the model.