Optimal Design of Actuators and Sensors for Distributed Parameter Systems

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Abstract: Finding the best actuator location to control a distributed parameter system can improve performance and significantly reduce the cost of the control. Similarly, design and location of the sensors is important to estimation. The existence of an optimal actuator location has been established for linear partial differential equations (PDEs) with various cost functions. This optimal actuator design is done concurrently with design of an optimal controller. Examples show that the cost function is important. Placing actuators based on consideration of controllability is not generally optimal in terms of controlled system performance. These results have been extended to interesting but mathematically and computationally challenging problem of optimizing over a family of actuator shapes, or designs. Similar questions for estimation are also addressed and illustrated with examples.