**Systems and Control Seminar**
Fujita and Hatanaka Group
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# Two-time-scale Internal Model Designs for Multi-agent Systems

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**Prof. He Bai**
**Mechanical and Aerospace Engineering**
**Oklahoma State University**

Abstract
Multi-agent systems have found numerous civil, military, and scientific applications, such as monitoring and rescue, formation flying, target tracking, interferometry missions, among many others. The internal model principle has been recognized as an important tool in designing distributed control and estimation algorithms for multi-agent systems. One of the main assumptions in internal model based distributed algorithms is that partial model information of an exogenous system is available for control designs. However, for practical applications of multi-agent systems, the required model information may not be available a priori or can change over time in dynamical environments.
In this talk, I will discuss my recent work on designing adaptive internal model based distributed algorithms which relax the requirement of partial model information. Particularly, I will present an input-output based two-time-scale framework. In this framework, the agents collaboratively estimate the required model information on a slow time scale and coordinate their motion using the estimated model on a fast time scale. Input-output properties inherent in agent dynamics, such as passivity, together with graph theory, will be employed to derive stable and modular control and estimation algorithms. Two-time-scale averaging theory will be applied to simplify the design and analysis of distributed algorithms.