1. Abstracts of two lectures

Lecture 1: **Estimation and Control in Quantum Technology**

Quantum technology is a promising future technology where unique quantum characteristics are taken advantage of to develop faster computation, securer communication and high-precision sensing than their classical (non-quantum) counterparts. In this lecture, we will introduce several results on state estimation, parameter identification and robust control in quantum technology. First, an efficient method of linear regression estimation (LRE) is presented for quantum state tomography. Adaptive quantum state tomography and quantum filtering will also be discussed. Second, we present a couple of results on quantum Hamiltonian identification where error upper bounds are established and computational complexity is analyzed. Hamiltonian identifiability is investigated using a similarity transformation approach and its application to quantum sensors is discussed. Then, we present some results on quantum robust control which aims to enhance the robustness of quantum systems with uncertainties and noise. Lastly, we outline several future research directions.

Lecture 2: **Improved reinforcement learning with applications in robotics, games and quantum engineering**

Reinforcement learning (RL) addresses the problem of how an autonomous active agent can learn to approximate an optimal behavioral strategy while interacting with its environment. It has been widely applied in various areas including artificial intelligence, control engineering, operations research and robotics. In this lecture, we will introduce several improved reinforcement learning algorithms including incremental reinforcement learning, quantum reinforcement learning, quantum-inspired deep reinforcement learning. We will also demonstrate several applications of these improved reinforcement learning algorithms to robotics, games and quantum engineering.