Program Schedule

Venue: Room 1038 (1/F), Institute for Advanced Study, Lee Shau Kee Campus of HKUST

6 January 2014 (Monday)		
Time	*Event*	*Presenter*
10:00 – 10:15	Opening Remarks	LI Qiu *[HKUST]*
10:15 – 11:00	Talk #1: "Controllability of Complex Networks"	Guanrong (Ron) Chen *[City University of Hong Kong]*
11:00 – 11:15	Tea Break	
11:15 – 12:00	Talk #2: "Multi-objective Multi-agent Systems"	Wing Shing Wong *[The Chinese University of Hong Kong]*
12:00 – 14:00	Lunch Break	
14:00 – 14:45	Talk #3: "The Future of Possible"	Tao Wang *[DJI Innovations]*
14:45 – 15:30	Talk #4: "Local Analysis of Nonlinear Behavior in Financial Engineering"	Xiren Cao *[Shanghai Jiao Tong University & HKUST IAS]*
15:30 – 15:45	Tea Break	
15:45 – 16:30	Talk #5: "Duration-differentiated Electric Service for Integrating Renewable Power"	Pravin Varaiya *[University of California at Berkeley & HKUST IAS]*
16:30 – 17:15	Panel Discussion on Future Directions	

Abstracts

Controllability of Complex Networks

(Talk #1)

Guanrong (Ron) Chen

City University of Hong Kong

In this talk, we discuss some theoretical as well as technical issues faced by the conventional control theory in a complex dynamical network environment. Motivated by a few network-based challenges to control theory, we present some research problems regarding pinning control and controllability of complex directed networks. We will show that the coupling structure of a network is essential for its controllability; therefore, effectively utilizing the topological features of a network to benefit control is of ultimate importance. This also raises some interesting and yet challenging technical questions for control theory and practice under the framework of directed and weighted dynamical networks with complex topologies.

Multi-objective Multi-agent Systems

(Talk #2)

Wing Shing Wong

The Chinese University of Hong Kong

Increasingly more networked control systems are premised on an open access philosophy. As different agents join the system they may invoke different sets of objectives. As a consequence, a basic challenge that arises is how to design distributed control algorithms under uncertainties in the objective functions.

In this talk we will start with some concrete examples to illustrate the basic concept of multi-objective, multi-agent systems. These examples range from power control in mobile communication, to sensor positioning, and to strategic games. We will then discuss the close interplay between communication and control for such systems, in particular, how communication affects the control solution. Results on the optimal controls for various dynamical systems will also be presented.

The Future of Possible

(Talk #3)

Tao Wang

DJI Innovations

Tao Wang, the founder of DJI, was always fascinated with flight and would always daydream about flying during his early childhood years. In 2006, he finished his final year project at HKUST - UAS flight control and afterwards took this opportunity to start DJI in Shenzhen as the Chief Executive Officer and Chief Technical Officer.

DJI is the global leader in developing and manufacturing high performance, reliable, and easy-to-use small unmanned aerial systems (UAS), for commercial and recreational use. DJI is dedicated to making aerial photography and videography accessible to professional photographers, cinematographers and hobbyists anytime, anywhere. With global operations in North America, Europe and Asia and over 1,000 employees, the Company has archived 3 to 5 times growth per year over the past three years.

Local Analysis of Nonlinear Behavior in Financial Engineering

(Talk #4)

Xiren Cao

Shanghai Jiao Tong University and HKUST IAS

In finance, it has been long realized that the expected utility theory cannot explain many "irrational behavior," which is nonlinear in nature. Theories and methodologies have been developed for characterizing such non-linear behavior and dealing with portfolio optimization problem with the non-linear criteria. These problems are difficult because of the non-linear nature. However, this nonlinear nature makes sensitivity analysis, which is widely used in control problems, a suitable tool in exploring the nature of such problems. Our recent research explores the local properties in non-linear behavior analysis and their relations to the global ones.

One important property we discovered is the so called mono-linearity, which says that Yaari's representation in fact maintains some local linearity. With the mono-linearity, we proceed in three directions. 1. Just like in perturbation analysis, the mono-linearity allows use sample path based derivatives as the unbiased estimate of the performance gradient; therefore, we develop algorithms for performance optimization in portfolio management and develop theory for it. The results are consistent with those with Zhou's; and the method can also be applied to new problems. 2. The mono-linearity explains, in one angle, why Yaari's theory cannot explain some paradoxes, and we developed new axioms to extend Yaari's axiomatic approach; in particular, we proved that the famous independent axiom can be replaced by a local linear axiom, and thus simplified the theory. 3. We study other non-liner behavior when the mono-linearity does not hold; e.g., the theory with disappointment and more.

Duration-differentiated Electric Service for Integrating Renewable Power

(Talk #5)

Pravin Varaiya

University of California at Berkeley and HKUST IAS

Electric power produced from renewable resources like wind and solar is variable: it is uncontrollable, intermittent and uncertain. Variability is a challenge for renewable integration. Supply-side approaches to this challenge make careful use of reserve generation to compensate for the variability. But with increased renewable penetration, the cost of reserves will raise the cost of electricity and diminish the net carbon benefit from renewables. This has led to growing interest in approaches that seek to tailor electricity demand to variable electric supply. The idea is to use the flexibility customers have in meeting their energy needs to match the variable supply. Pursuit of this idea raises questions: how can this flexibility be identified, what forms does it take, and what incentives can be used to extract this flexibility?

We propose a stylized model of flexibility. Time is slotted, $t = 1, \dots, T$. Customer $i = 1, \dots, n$ wants 1kW of power to be delivered over *any* h_i (out of T) slots. Call $h = (h_1, \dots, h_n)$ the demand profile. Renewable power of *pt* kW is available in slot *t*. Call $p = (p_1, \dots, p_T)$, the supply profile. We answer these questions: when is p adequate to meet h? If it is not, what is the least amount of grid power needed to make p adequate? Can we design a market, i.e., a commodity structure and prices, that shapes the demand to make p adequate? Various generalizations and questions of implementation will be discussed.