Department of Industrial Systems Engineering and Management
Faculty of Engineering

SEMINAR

Title:	**Dimensionality Reduction in Dynamic Decision-Making under Uncertainty**
Speaker:	**Dr. Napat Rujeerapaiboon** **Postdoctoral researcher at École polytechnique fédérale de Lausanne or EPFL**
Date:	**19 September 2017 (Tue)**
Start Time:	**9:30 a.m.**
End Time:	**10:50 a.m. (including Q&A session)**
Venue:	**Seminar Room, E1-06-08, Faculty of Engineering Blk 1, 6th floor**

Abstract:
Dynamic decision problems under uncertainty are traditionally solved by methods of dynamic and stochastic programming, both of which have been popularized in the 1950s. In today's complex and interconnected world, the applicability of these traditional methods is challenged because decision problems extend to higher dimensions and depend on increasing amounts of decision-relevant data. In this talk we develop complexity reduction and decomposition schemes, which exploit structural symmetries or multiscale properties of the decision problems at hand in order to break them down into smaller and more tractable components. The first part of the talk addresses a generic investment problem. We study the growth-optimal portfolio strategy, which maximizes the expected log-return over a single investment period. In a classical stochastic setting, this strategy is known to outperform any other investment strategy with probability 1 in the long run. In the short run, however, it is notoriously volatile. Moreover, its performance suffers in the presence of distributional ambiguity. We design efficiently computable fixed-mix strategies that offer similar performance guarantees as the classical growth-optimal portfolio but for a finite investment horizon and for all probability distributions that are consistent with the decision maker's prior information. In the second part of the talk, we consider a multi-market reservoir management problem. The eroding peak/off-peak spreads on European electricity spot markets imply reduced profitability for the hydropower producers and force them to participate in the balancing markets. This motivates us to propose a two-layer stochastic programming model for the optimal operation of a cascade of hydropower plants selling energy on both spot and balancing markets. The planning problem optimizes the reservoir management over a yearly horizon with weekly granularity, and the trading subproblems optimize the market transactions over a weekly horizon with hourly granularity. We solve both the planning and trading problems in linear decision rules, and we exploit the inherent parallelizability of the trading subproblems to achieve computational tractability and solve the problem in the timeframe consistent with operational requirements.

Biography:
Napat Rujeerapaiboon is a postdoctoral researcher at École polytechnique fédérale de Lausanne or EPFL. He has obtained a Bachelor of Computer Engineering degree from Chulalongkorn University in Bangkok, Thailand, and he holds an MSc degree with summa cum laude honours in Computational Management Science from the Department of Computing at Imperial College London. From 2012 until 2016 he was a PhD student in the Department of Computing at Imperial College London and at the Risk Analytics and Optimization chair at EPFL. His master's thesis was awarded a distinguished prize at Imperial College London, and his PhD thesis was awarded the best dissertation prize for the period 2014–2017 of the Swiss Operations Research Society. He is primarily interested in the utilization of big data for decision making under uncertainty. His main application areas are operations management, energy systems, and finance.