THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

PROBABILITY AND INFORMATION THEORY SEMINAR

Chance Constrained Stochastic Optimization in Wireless Communication System

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Abstract

Providing performance reliability in uncertain environment is an important task, yet a crucial challenge to many engineering problems. Especially for nowadays high speed wireless communication system (WCS), obtaining accurate Channel State Information at transmitter (CSIT) for scheduler design is an impossible task, henceforth robust design is of critical concern. In this thesis, we study how to achieve various design objectives in such adverse scenarios by modeling as different Chance Constrained Stochastic Optimization (CCSO) problems; particularly we introduce three novel problems and corresponding solutions as follows.

First is to study throughput optimization under heterogeneous delay constraints, via our proposed simple queueing theoretical formula for rate equivalence of delay performance. Second is about distributive implementation and feedback reduction technique via a statistical tool called extreme value theory; while the first two problems are studied under the classical error distribution model approach, our third contribution would propose a new CCSO framework which allows one to get rid of Cumulative Distribution Function (CDF) assumption of the uncertainty. Our approach further provides significant performance enhancement over classical CCSO by introducing an information-adaptive procedure that distinguishes uncertainty into useful information and noise, instead of existing single type of uncertainty.

We focus on demonstrating the applicability of all these three results through a widely deployed example in WCS called Orthogonal Frequency Division Multiple Access (OFDMA) system. In particular, we are the first one to provide an optimal joint-subcarrier encoding design, with jointly optimal subcarrier and power allocation satisfying the outage constraint. Furthermore, both in simulation and theory, we see performance enhancements of our schemes over existing CSIT-error inconsiderate scheme, and their capability to provide aforementioned novel functionality: providing delay constraints satisfaction, distributive design with low feedback overhead, and online design in absence of CSIT error statistics, without incurring extra complexity and with convergence proofs of proposed algorithms.

Date:	October 3, 2014 (Friday)
Time:	3:00 – 4:00pm
Place:	Room 309, Run Run Shaw Bldg., HKU

All are welcome