Optimized Resource Allocation in Wireless Systems

By

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Abstract

Modern wireless systems rely to a great extent on the judicious distribution of available resources (e.g. power, bandwidth) to meet an ever increasing demand of better quality-of-service (QoS). Scarcity of these resources with time, coupled with the tremendous growth in numbers of users, network throughput, and applications, have resulted in making the problem of optimal resource allocation extremely important especially in wireless networks.

Generally, optimization problems posed in the resource allocation framework are nonconvex and thus render it difficult to find an optimal solution. Previous studies on this subject have reported only numerically cumbersome and non-tractable solutions. This dissertation attempts to exploit the hidden convexity of the resource allocation problems under some given performance criteria such as minimum mean square error (MMSE) or signal-to-interference-plus-noise ratio (SINR) and then successfully finds tractable optimization formulations.

The first research problem deals with the optimal power allocation and sensor assignment in linear and nonlinear networks for static and dynamic target tracking. The proposed method casts power allocation as a semi-definite program (SDP) while sensor selection is solved via d.c. (difference of convex functions/sets) programming. The second problem considers optimal beamforming and source power allocation in relay-assisted multiuser communication. This problem is further extended to include multiple-antenna systems to exploit spatial diversity in modern cellular communication by jointly optimizing source precoding and relay processing matrices. Supremacy of the proposed d.c. programming based iterative algorithm over existing methods is demonstrated via extensive simulations.

Originality Statement

'I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at UTS or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked at UTS or elsewhere, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic expression is acknowledged.'

Signed: Umar Rashid

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SN	Sensor Network
FC	Fusion Center
MMSE	Minimum Mean Square Error
SDP	Semi-definite Programming
DCP	Difference of Convex Programming
UKF	Unscented Kalman Filter
LMI	Linear Matrix Inequality
LFT	Linear Fractional Transformation
SINR	Signal to Interference Plus Noise Ratio
SDR	Semidefinite Relaxation
MIMO	Multiple Input Multiple Output
s.t.	Subject to