



Hamilton Institute

Spectrum Sharing in Cognitive Radio with Quantized Channel Information

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Abstract:

In this talk, We consider a wideband spectrum sharing system where a secondary user can share a number of orthogonal frequency bands each licensed to a distinct primary user. We address the problem of optimum secondary transmit power allocation for its ergodic capacity maximization subject to an average sum (across the bands) transmit power constraint and individual average interference constraints on the primary users. The major contribution of our work lies in considering quantized channel state information (CSI) (for the vector channel space consisting of all secondary-to-secondary and secondary-to-primary channels) at the secondary transmitter as opposed to the prevalent assumption of full CSI in most existing work. It is assumed that a band manager or a cognitive radio service provider has access to the full CSI information from the secondary and primary receivers and designs (offline) an optimal power codebook based on the statistical information (channel distributions) of the channels and feeds back the index of the codebook to the secondary transmitter for every channel realization in real-time, via a delay-free noiseless limited feedback channel. A modified Generalized Lloyds-type algorithm (GLA) is designed for deriving the optimal power codebook, which is proved to be globally convergent and empirically consistent. An approximate quantized power allocation (AQPA) algorithm is presented, that performs very close to its GLA based counterpart for large number of feedback bits and is significantly faster. We also present an extension of the modified GLA based quantized power codebook design algorithm for the case when the feedback channel is noisy. Numerical studies illustrate that with only 3-4 bits of feedback, the modified GLA based algorithms provide secondary ergodic capacity very close to that achieved by full CSI and with only as little as 4 bits of feedback, AQPA provides a comparable performance, thus making it an attractive choice for practical implementation. Various open problems and future research directions will also be discussed.

Venue: Seminar Room, Hamilton Institute, Rye Hall,
NUI Maynooth

Time: 2.00 - 3.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie