von Wrycza, Peter; **Shankar, M. R. Bhavani**; **Bengtsson, Mats**; **Ottersten, Björn**
Spectrum allocation for decentralized transmission strategies: properties of Nash equilibria.
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Summary: The interaction of two transmit-receive pairs coexisting in the same area and communicating using the same portion of the spectrum is analyzed from a game theoretic perspective. Each pair utilizes a decentralized iterative water-filling scheme to greedily maximize the individual rate. We study the dynamics of such a game and find properties of the resulting Nash equilibria. The region of achievable operating points is characterized for both low- and high-interference systems, and the dependence on the various system parameters is explicitly shown. We derive the region of possible signal space partitioning for the iterative water-filling scheme and show how the individual utility functions can be modified to alter its range. Utilizing global system knowledge, we design a modified game encouraging better operating points in terms of sum rate compared to those obtained using the iterative water-filling algorithm and show how such a game can be imitated in a decentralized noncooperative setting. Although we restrict the analysis to a two player game, analogous concepts can be used to design decentralized algorithms for scenarios with more players. The performance of the modified decentralized game is evaluated and compared to the iterative water-filling algorithm by numerical simulations.

MSC:

94A12 Signal theory (characterization, reconstruction, filtering, etc.)
91A80 Applications of game theory
91A40 Other game-theoretic models

Full Text: DOI

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