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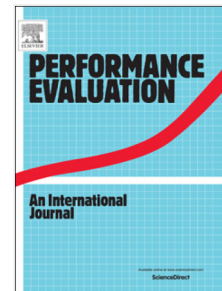
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Opportunistic scheduling with flow size information for Markovian time-varying channels

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Abstract

Opportunistic scheduling refers to algorithms that try to exploit the random variations of the physical layer channel quality in wireless systems for the allocation of radio resources. As indicated by some recent papers, a promising approach to optimize the resource allocation in such a context is to utilize the notion of Whittle index, originally developed for restless multi-armed bandits. In this paper, we apply the Whittle index approach for the opportunistic scheduling problem of downlink data flows assuming two-state Markovian time-varying channels. Until now, this has been done only for geometric flow sizes. Our aim is to allow arbitrary flow size distributions and study how to optimally combine opportunistic scheduling with exact flow size information. We use a phase-type approximation for the flow sizes to make the problem amenable to the Whittle index approach. In the first step, we show that the opportunistic scheduling problem is indexable for Erlang distributed flow sizes and derive the corresponding Whittle index, which generalizes earlier results. In the second step, we utilize these results to develop a size-aware index policy for the original problem. The result is also heuristically generalized to cover Markovian channels with multiple states. By simulation-based numerical studies, we demonstrate that the resulting size-aware index policy is able to appropriately make use of the more exact size information and thus systematically improves performance when compared to earlier developed schedulers.

Keywords: Opportunistic scheduling, size-aware scheduling, Markovian time-varying channel, Whittle index, restless bandit

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