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Title:
Fluid and diffusion analysis of polling systems

Abstract:
Polling stations are multi-class queueing stations that incur some form of setup penalty when switching processing focus from one job class to another. The penalty can take the form of a setup time or cost. In response to these penalties, service scheduling policies for polling stations typically have two distinguishing elements: the length of the production run, during which only one class of jobs is served, and the polling sequence, which dictates how the server chooses the next class to "visit" at the conclusion of a production run.

We first review application areas of polling systems and classical methods of analysis. We then turn our attention with new methods to diffusion approximations of heavily loaded polling stations as well as stability analysis of polling systems. . The diffusion approximations are obtained via (weak) limit theorems of the diffusion-scaled workload and queue length processes; the limits are expressed as reflected multi-dimensional Brownian motion, more general diffusion processes with state-dependent drift and jumps, and averaging principles. Such limits lend themselves to approximate optimal scheduling.