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Instability and stability of parameter agnostic policies in parallel server systems

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We analyze the stability properties of parameter agnostic service policies for parallel server systems. Parameter agnostic policies rely only on the current systems state to make service decisions, thus eliminating the need for knowledge about system parameters, making them potentially appealing to deploy in practice.

We focus on a broad and natural class of parameter agnostic policies, which are characterized by increasing switching curves, and we consider their performances in the X-model, a simplest class of parallel server systems for which the stability question is unknown. Our main result is large negative: Essentially, for any switching curve policy, there exists instances of stabilizable parameters under which the given policy leads to instability. The proof involves a novel coupling with a state-dependent birth-death process, which may be of independent interest. In addition, we study various classes of parameter agnostic policies and characterize their regions of instability.

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