

Variational calculus for dynamical system optimization with dynamic rate queueing applications

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The dynamic optimization of constrained dynamical systems is based on the calculus of variations and its various incarnations over the past three centuries. Various fluid and diffusion limit theorems give us many dynamic rate queueing systems that are well approximated by related low dimensional dynamical systems.

This is a tutorial that discusses these optimization methods by introducing the concepts of Lagrangians, Hamiltonians, and Bellman value functions. The performance and management of services derived from the leasing of shared resources modeled by queueing systems provide us with many examples that apply and illustrate these optimizing techniques.

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