STOCHASTIC OPTIMAL CONTROL FOR A CLASS OF DYNAMIC RESOURCE ALLOCATION PROBLEMS

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We consider a class of general dynamic resource allocation problems within a stochastic optimal control theoretic framework. This class of problems arises in a wide variety of applications, particularly in the area of energy-aware scheduling, each of which intrinsically involves resources of different types and demand with uncertainty. The goal is to determine the allocation capacity for every resource type in order to serve the uncertain demand and maximize the expected profit over a time horizon of interest based on the rewards and costs associated with the different resources. We derive the optimal control policy within a singular stochastic optimal control setting, which includes simple expressions for governing the dynamic adjustments to resource allocation capacities over time. Numerical experiments investigate various issues of both theoretical and practical interest, quantifying the significant benefits of our approach over alternative optimization approaches.