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The Rocky Mountain INFORMS Chapter is pleased to host Hojun Choi, an Assistant Professor in Economics and Business at Colorado School of Mines. His primary research focuses on how to allocate scarce resources in complex systems with applications in service operations, supply chains, and energy and critical minerals networks. He uses stochastic modeling, optimal control, game theory, and econometrics to analyze operational and policy challenges. He received his Ph.D. from Northwestern University.
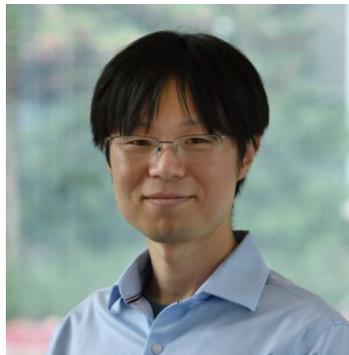
Title: Optimal Clearing of a Two-Class Queue with Peer-Driven Abandonment

Abstract: Recent disruptions in semiconductor and critical-mineral supply chains highlight the growing challenge of allocating scarce technological resources across competing sectors. During the global chip shortage, automobile manufacturers continued producing vehicles but temporarily disabled chip-intensive optional features, allowing limited semiconductor supplies to be concentrated on core vehicle functionality. Similar pressures arise in the defense sector, where shortages of specialized electronics force contractors to prioritize scarce resources towards the most critical projects. Emerging shortages of critical minerals suggest that such allocation challenges may become increasingly common across both commercial and defense sectors.

We study this phenomenon as an optimal queue-clearing problem in which a planner dynamically allocates a scarce resource between sectors with evolving backlogs of production demand. We show that the optimal policy has a bang-bang structure, allocating supplies entirely to one sector at a time. Moreover, the optimal policy exhibits three distinct parameter regimes, each corresponding to a different priority structure between sectors. Finally, we propose a simple, practical allocation rule that approximates the optimal switching policy. Numerical experiments show that this heuristic performs near optimally.