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The Rocky Mountain INFORMS Chapter is pleased to host Professor Rui Zhang, an assistant professor in the Strategy, Entrepreneurship and Operations division at Leeds School of Business, University of Colorado Boulder. He received his Ph.D. in Management Science from the Robert H. Smith School of Business at the University of Maryland. His research interests are in quantitative methods, especially prescriptive analytics techniques. His work focuses on developing novel methods for revenue management problems and influence maximization problems on social networks. He also works on new operation modes for last-mile delivery problems. His work has been published in *Operations Research*, *INFORMS Journal on Computing*, *INFORMS Journal on Optimization*, *Naval Research Logistics*, *European Journal of Operational Research*, *Networks*, and *Computers & Operations Research*, among other outlets. Currently, he is serving as an Associate Editor for the journal *Networks*.

Title Product-Based Approximate Linear Programs for Network Revenue Management

Abstract The approximate linear programming approach has received significant attention in the network revenue management literature. A popular approximation in the existing literature is separable piecewise linear (SPL) approximation, which estimates the value of each unit of each resource over time. SPL approximation can be used to construct resource-based bid-price policies. In this paper, we propose a product-based SPL approximation. The coefficients of the product-based SPL approximation can be interpreted as each product's revenue contribution to the value of each unit of each resource in a given period. We show that the resulting approximate linear program (ALP) admits compact reformulations, like its resource-based counterpart. Furthermore, the new approximation allows us to derive a set of valid inequalities to (i) speed up the computation and (ii) select optimal solutions to construct more effective policies. We conduct an extensive numerical study to illustrate our results. In a set of 192 problem instances, bid-price policies based on the new approximation generate higher expected revenues than resource-based bid-price policies, with an average revenue lift of 0.72% and a maximum revenue lift of 5.3%. In addition, the new approximation can be solved 1.42 times faster than the resource-based approximation and shows better numerical stability. The valid inequalities derived from the new approximation further improve the computational performance and are critical for achieving additional gains in the expected revenue. The policy performance is competitive compared with the dynamic programming decomposition method, which is the strongest heuristic known in the literature.