1106-90-2525 **Ilbin Lee**, **Marina A Epelman*** (mepelman@umich.edu), **H Edwin Romeijn** and **Robert L Smith**. *Countably-infinite linear programming approaches and simplex-type algorithms for Markov Decision Processes.*

Countably-infinite linear programs (CILPs) are linear programs with countably-infinite number of variables and constraints. They are challenging to analyze or solve since useful properties of finite LPs fail to extend to general CILPs. However, for some structured CILPs, e.g., ones arising as formulations of Markov Decision Processes (MDPs) with countably infinite state spaces, we show that duality, complementary slackness, and a simple analytical representation of extreme points extend to the countably infinite case. In addition, we suggest a simplex-type algorithm for such CILPs and prove its convergence to optimality. Each iteration requires only finite computation, so the algorithm can be used as an iterative solution method for MDPs with countably infinite state spaces. Previous solution methods for such MDPs involved solving finite-state truncations, or estimating the reward function for a finite subset of states. Sequences of MDP policies produced by these methods as the number of states considered increases converge to optimality in value, but convergence may not be monotonic. In contrast, our simplex-based method generates improving policies at each iteration — a desirable feature. Time permitting, we will discuss other types of infinite MDPs amenable to such analysis. (Received September 16, 2014)