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Summary: The world that we live in is filled with large scale agent systems, from diverse fields such as biology, ecology or finance. Inspired by the desire to better understand and make the best out of these systems, we propose to build stochastic mathematical models, in particular G-networks models. With our approach, we aim to provide insights into systems in terms of their performance and behavior, to identify the parameters which strongly influence them, and to evaluate how well individual goals can be achieved. Through comparing the effects of alternatives, we hope to offer the users the possibility of choosing an option that address their requirements best. We have demonstrated our approach in the context of urban military planning and analyzed the obtained results. The results are validated against those obtained from a simulator that was developed in our group and the observed discrepancies are discussed. The results suggest that the proposed approach has tackled one of the classical problems in modeling multi-agent systems and is able to predict the systems' performance at low computational cost. In addition to offering the numerical estimates of the outcome, these results help us identify which characteristics most impact the system. We conclude the paper with potential extensions of the model.

MSC:

90B06 Transportation, logistics and supply chain management
90B15 Stochastic network models in operations research

Keywords:

mathematical modeling; g-networks; military strategy and planning; multi-agent systems

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