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The Team

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Dynamic systems, online problems, ADP, stochastic programming, and simulation optimization

- Goals:

1. Priorities for research
2. Barriers to practice
3. Next steps

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Barriers to Practice

- Modeling: It is difficult to:
  - understand methods intuitively
  - conduct experiments with live data/true online
  - identify "true" objectives
- Algorithmic: It is difficult to:
  - identify a single method that fits all problems
  - (how to tailor methods for specific problems)
- Computational: It is difficult to:
  - restrict to sampling methods when other numerical methods may perform better
  - overcome the curse of dimensionality
  - **take advantage of the power of parallel processing, e.g., GPUs**
- Structure: it is difficult to develop intuition for higher dimensions (most methods based on two-dimensional intuition)

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Priorities: Modeling

1. What is the right objective and what are the right constraints to optimize?
2. **How do robust and other risk-based methods with input uncertainty relate to expected value optimization?**
3. How to incorporate convexification methods, such as second-order stochastic dominance, into simulation optimization?
4. How to estimate the value function and transition density simultaneously?
5. How to learn distributions over time?
6. How to model interactions with the external environment?

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Priorities: Algorithms

1. **How to determine optimality gaps for algorithms in simulation optimization?**
2. What metrics should be used for evaluating algorithms for simulation optimization?

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Priorities: Computation

1. How to choose coefficients in ADP, e.g., use simulation optimization v. regression?
2. How to optimize over parameterizations of policies, i.e., optimizing in policy-parameter space, e.g., using decision rules?
3. **How to use DP insights to control simulation optimization?**
4. How to use dynamic methods, e.g., filtering, in simulation optimization for partially observable state spaces?

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Priorities: Structure

1. **What are different problem transformations to reduce dimension and complexity?**
2. What are the structures of dynamic problems that can be exploited (e.g., optimal policy structures)?

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Next Steps

1. **Create contest on www.simopt.org with $ from Robert Smith**
   - **Specification: Given data with separate instance for evaluation/family of problems/machine for evaluation**
   - **Solution: Code/decision variable values/description**
   - **Evaluation: Best (C.I.) solution (unrestricted) or best within time window/Best on selection of problems**
   - **Process: ?**
2. **Start open-source library for simulation optimization problems and algorithms**
3. Create sessions at conferences focused on research priorities
4. Organize journal special issue around questions