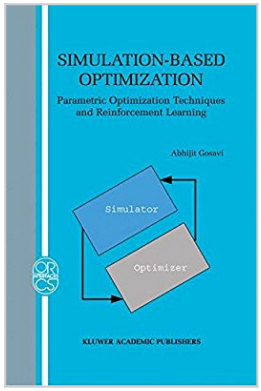


# Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series)

*By Abhijit Gosavi*



**Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series)** By Abhijit Gosavi

This book introduces the evolving area of simulation-based optimization. Since it became possible to analyze random systems using computers, scientists and engineers have sought the means to optimize systems using simulation models. Only recently, however, has this objective had success in practice. Cutting-edge work in computational operations research, including dynamic programming, e.g., **Reinforcement Learning** (RL) or **Approximate Dynamic Programming** (ADP), and static optimization via Stochastic Adaptive Search, e.g., Simultaneous Perturbation and Meta-Heuristics, has made it possible to use simulation in conjunction with optimization techniques. Some special features of the book include:

- An Accessible Introduction to Reinforcement Learning Techniques for Solving **Markov Decision Processes** (**MDPs**)
- A Step-by-Step Description of Stochastic Adaptive Search Algorithms, e.g., **Simultaneous Perturbation**, **Simulated Annealing**, **Tabu Search**, and **Genetic Algorithms**, for Static Simulation-Based Optimization
- A Clear and Simple Introduction to the Methodology of **Neural Networks**
- A Gentle Introduction to Convergence Analysis of a Subset of Methods Enumerated Above
- A Clear Discussion on Dynamic Programing for Solving MDPs and Semi-MDPs (**SMDPs**)
- An In-Depth Treatment of RL Methods for SMDPs and **Average Reward** Problems
- Computer Programs

This book is written for students and researchers in the fields of engineering (industrial, electrical, and computer), computer science, operations research, management science, and applied mathematics. An attractive feature of this

book is its **accessibility** to readers new to this topic.

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## Editorial Review

Review
The following reviews are from Google books and may have been corrected for minor grammatical errors:

"One of the great books. I have found every detail I needed and he has done (an) excellent job. I will definitely recommend the book." -- *A reader from Google Books*

From the Author
The main motivation for writing this book was to provide an **accessible** account of methods based on **Reinforcement Learning** (closely related to what is now also called *Approximate Dynamic Programming*) and **Meta-Heuristics** (closely related to what is now also called *Stochastic Adaptive Search*) for optimization in discrete-event systems via simulation. Reinforcement Learning (RL) is typically used for solving Markov decision problems (**MDPs**), which are dynamic optimization problems where the underlying discrete-event stochastic system is driven by Markov chains, while Meta-Heuristics are used for solving static optimization problems where the underlying system is any discrete-event stochastic system (not necessarily driven by Markov chains).
This book provides a selected collection of topics, mostly focused on **model-free** techniques, which are useful when one does not have access to the structure of the objective function (in static optimization) or the transition probability function (in dynamic optimization). My goal was neither to overwhelm the reader with mathematical details nor was it to cover every topic. Rather, the goal was to provide the reader with an overview of the fundamental concepts and at the same time provide the details required for solving real-world stochastic optimization problems via simulation-based techniques.
Some of the main topics covered are:

- Reinforcement learning techniques, mainly rooted in **Q-Learning** for discounted and average reward MDPs
- Static optimization techniques rooted in meta-heuristics (**simulated annealing**, **genetic algorithms**, and **tabu search**) for discrete solution spaces and **simultaneous perturbation** for continuous solution spaces
- **Neural network** algorithms useful for function approximation in response surface methods for static optimization and in reinforcement learning for MDPs with large state-action spaces
- A detailed background on **dynamic programming** (**value and policy iteration**)
- A special coverage of semi-MDPs (**SMDPs**) and **average reward** problems
- A discussion on convergence of a subset of methods enumerated above

From the Back Cover

***Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning*** introduces the evolving area of static and dynamic simulation-based optimization. Covered in detail are *model-free* optimization techniques – especially designed for those discrete-event, stochastic systems which can be simulated but whose analytical models are difficult to find in closed mathematical forms.

**Key features of this revised and improved Second Edition include:**

· Extensive coverage, via step-by-step recipes, of powerful new algorithms for static simulation optimization, including simultaneous perturbation, backtracking adaptive search, and nested partitions, in addition to traditional methods, such as response surfaces, Nelder-Mead search, and meta-heuristics (simulated annealing, tabu search, and genetic algorithms)

· Detailed coverage of the Bellman equation framework for Markov Decision Processes (MDPs), along with dynamic programming (value and policy iteration) for discounted, average, and total reward performance metrics

· An in-depth consideration of dynamic simulation optimization via temporal differences and Reinforcement Learning: *Q-Learning*, *SARSA*, and *R-SMART* algorithms, and policy search, via *API*, *Q-P-Learning*, actor-critics, and learning automata

· A special examination of neural-network-based function approximation for Reinforcement Learning, semi-Markov decision processes (SMDPs), finite-horizon problems, two time scales, case studies for industrial tasks, computer codes (placed online), and convergence proofs, via Banach fixed point theory and Ordinary Differential Equations

Themed around three areas in separate sets of chapters – **Static Simulation Optimization, Reinforcement Learning,** and **Convergence Analysis** – this book is written for researchers and students in the fields of engineering (industrial, systems, electrical, and computer), operations research, computer science, and applied mathematics.

## Users Review

**From reader reviews:**

**Kevin Santiago:**

This book untitled Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series) to be one of several books that will best seller in this year, that is because when you read this publication you can get a lot of benefit in it. You will easily to buy that book in the book retail store or you can order it through online. The publisher on this book sells the e-book too. It makes you quicker to read this book, as you can read this book in your Smart phone. So there is no reason for your requirements to past this e-book from your list.

**Juanita Cooke:**

People live in this new day of lifestyle always try and and must have the spare time or they will get great deal of stress from both way of life and work. So , when we ask do people have time, we will say absolutely of course. People is human not only a robot. Then we request again, what kind of activity are there when the spare time coming to anyone of course your answer will unlimited right. Then do you try this one, reading books. It can be your alternative with spending your spare time, the particular book you have read is definitely Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series).

**Ronald Dotson:**

Do you have something that you prefer such as book? The guide lovers usually prefer to choose book like comic, quick story and the biggest one is novel. Now, why not trying Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series) that give your enjoyment preference will be satisfied through reading this book. Reading behavior all over the world can be said as the way for people to know world much better then how they react to the world. It can't be claimed constantly that reading habit only for the geeky man but for all of you who wants to be success person. So , for every you who want to start studying as your good habit, it is possible to pick Simulation-Based Optimization: Parametric Optimization Techniques and Reinforcement Learning (Operations Research/Computer Science Interfaces Series) become your current starter.

**Bonnie Vassallo:**

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