



# Handbook of Learning and Approximate Dynamic Programming

*From Wiley-IEEE Press*



**Handbook of Learning and Approximate Dynamic Programming** From Wiley-IEEE Press

- A complete resource to Approximate Dynamic Programming (ADP), including on-line simulation code
- Provides a tutorial that readers can use to start implementing the learning algorithms provided in the book
- Includes ideas, directions, and recent results on current research issues and addresses applications where ADP has been successfully implemented
- The contributors are leading researchers in the field

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### Editorial Review

#### Review

"...highly recommended to researchers, graduate students, engineers, and scientists..." (*E-STREAMS*, February 2006)

"Clearly, this book is useful for researchers who do or want to do research on ADP." (*IIE Transactions-Quality & Reliability Engineering*, February 2006)

"...I would like to congratulate the editors, for putting together this wonderful collection of research contributions." (*Computing Reviews.com*, March 18, 2005)

#### From the Back Cover

Approximate dynamic programming solves decision and control problems

While advances in science and engineering have enabled us to design and build complex systems, how to control and optimize them remains a challenge. This was made clear, for example, by the major power outage across dozens of cities in the Eastern United States and Canada in August of 2003. Learning and approximate dynamic programming (ADP) is emerging as one of the most promising mathematical and computational approaches to solve nonlinear, large-scale, dynamic control problems under uncertainty. It draws heavily both on rigorous mathematics and on biological inspiration and parallels, and helps unify new developments across many disciplines.

The foundations of learning and approximate dynamic programming have evolved from several fields—optimal control, artificial intelligence (reinforcement learning), operations research (dynamic programming), and stochastic approximation methods (neural networks). Applications of these methods span engineering, economics, business, and computer science. In this volume, leading experts in the field summarize the latest research in areas including:

- Reinforcement learning and its relationship to supervised learning
- Model-based adaptive critic designs
- Direct neural dynamic programming
- Hierarchical decision-making
- Multistage stochastic linear programming for resource allocation problems
- Concurrency, multiagency, and partial observability
- Backpropagation through time and derivative adaptive critics
- Applications of approximate dynamic programming and reinforcement learning in control-constrained agile missiles; power systems; heating, ventilation, and air conditioning; helicopter flight control; transportation and more.

#### About the Author

JENNIE SI is Professor of Electrical Engineering, Arizona State University, Tempe, AZ. She is director of Intelligent Systems Laboratory, which focuses on analysis and design of learning and adaptive systems. In addition to her own publications, she is the Associate Editor for IEEE Transactions on Neural Networks, and past Associate Editor for IEEE Transactions on Automatic Control and IEEE Transactions on Semiconductor Manufacturing. She was the co-chair for the 2002 NSF Workshop on Learning and Approximate Dynamic Programming.

ANDREW G. BARTO is Professor of Computer Science, University of Massachusetts, Amherst. He is co-director of the Autonomous Learning Laboratory, which carries out interdisciplinary research on machine learning and modeling of biological learning. He is a core faculty member of the Neuroscience and Behavior Program of the University of Massachusetts and was the co-chair for the 2002 NSF Workshop on Learning and Approximate Dynamic Programming. He currently serves as an associate editor of Neural Computation.

WARREN B. POWELL is Professor of Operations Research and Financial Engineering at Princeton University. He is director of CASTLE Laboratory, which focuses on real-time optimization of complex dynamic systems arising in transportation and logistics.

DONALD C. WUNSCH is the Mary K. Finley Missouri Distinguished Professor in the Electrical and Computer Engineering Department at the University of Missouri, Rolla. He heads the Applied Computational Intelligence Laboratory and also has a joint appointment in Computer Science, and is President-Elect of the International Neural Networks Society.

## **Users Review**

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