Introduction to the Numerical Solution of Markov Chains

By William J. Stewart

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A cornerstone of applied probability, Markov chains can be used to help model how plants grow, chemicals react, and atoms diffuse--and applications are increasingly being found in such areas as engineering, computer science, economics, and education. To apply the techniques to real problems, however, it is necessary to understand how Markov chains can be solved numerically. In this book, the first to offer a systematic and detailed treatment of the numerical solution of Markov chains, William Stewart provides scientists on many levels with the power to put this theory to use in the actual world, where it has applications in areas as diverse as engineering, economics, and education. His efforts make for essential reading in a rapidly growing field.

Here Stewart explores all aspects of numerically computing solutions of Markov chains, especially when the state is huge. He provides extensive background to both discrete-time and continuous-time Markov chains and examines many different numerical computing methods--direct, single-and multi-vector iterative, and projection methods. More specifically, he considers recursive methods often used when the structure of the Markov chain is upper Hessenberg, iterative aggregation/disaggregation methods that are particularly appropriate when it is NCD (nearly completely decomposable), and reduced schemes for cases in which the chain is periodic. There are chapters on methods for computing transient solutions, on stochastic automata networks, and, finally, on currently available software. Throughout Stewart draws on numerous examples and comparisons among the methods he so thoroughly explains.

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Editorial Review

Review
"The book contains very rich material which is the result of long-term research in this field. No other book is known to the reviewer that treats this subject in such detail. . . . The book excellently reflects the great experience that the author has in the theory of Markov chains, matrix algebra, numerics and informatics. He . . . richly illustrates the book with numerous examples, flow-charts, pictures and even computer screen copies."**--*Mathematical Reviews***

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"The big attraction of this book is its timeliness: many engineers and scientists are currently becoming interested in iterative methods for solving large linear systems and eigenvalue problems. The book assembles together in a nicely presented form a large set of numerical techniques, including the most recently developed ones. It offers comparisons that will be very helpful to the specialist as well as the beginner. On the whole, this is an excellent text."--Yousef Saad, University of Minnesota

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From the Back Cover

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