



# Game Theory with Engineering Applications (Advances in Design and Control)

*Dario Bauso*

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Engineering systems are highly distributed collective systems - decisions, information, and objectives are distributed throughout - that have humans in the loop, and thus decisions may be influenced by socioeconomic factors. Engineering systems emphasize the potential of control and games beyond traditional applications. Game theory can be used to design incentives to obtain socially desirable behaviors on the part of the players, for example, a change in the consumption patterns on the part of the "prosumers"(producers-consumers) or better redistribution of traffic.

This unique book addresses the foundations of game theory, with an emphasis on the physical intuition behind the concepts, an analysis of design techniques, and a discussion of new trends in the study of cooperation and competition in large complex distributed systems.

**Audience:** This book is intended for undergraduate and graduate students and researchers in industrial, aeronautical, manufacturing, civil, mechanical, chemical, and electrical engineering. It is also designed for social scientists interested in quantitative methods for sociotechnical systems, biologists working on adaptation mechanisms and evolutionary dynamics, and physicists working on collective systems and synchronization phenomena.

**Contents:** List of Figures; List of Tables; List of Algorithms; Preface; List of Notation; Part I: Theory; Chapter 1: Introduction to Games; Chapter 2: Two-Person Zero-Sum Games; Chapter 3: Computation of Saddle-Points and Nash Equilibrium Solutions; Chapter 4: Refinement on Nash equilibrium Solutions, Stackelberg Equilibrium, and Pareto Optimality; Chapter 5: Coalitional Games; Chapter 6: Core, Shaply Value, Nucleolus; Chapter 7: Evolutionary Game Theory; Chapter 8: Replicator Dynamics and Learning in Games; Chapter 9: Differential Games; Chapter 10: Stochastic Games; Chapter 11: Games with Vector Payoffs: Approachability and Attainability; Chapter 12: Mean-Field Games; Part II: Applications; Chapter 13: Consensus in Multi-agent Systems; Chapter 14: Demand Side Management; Chapter 15: Synchronization of Power Generators; Chapter 16: Opinion Dynamics; Chapter 17: Bargaining; Chapter 18: Pedestrian Flow; Chapter 19: Supply Chain; Chapter 20: Population of Producers; Chapter 21: Cyber-Physical Systems; Appendix A: Mathematical Review; Appendix B: Optimization; Appendix C: Lyapunov Stability; Appendix D: Some Notions of Probability Theory; Appendix E: Stochastic Stability; Appendix F: Indistinguishability and Mean-Field Convergence; Bibliography; Index

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