Safe Robot Navigation Among Moving and Steady Obstacles

Andrey V. Savkin, Alexey S. Matveev, Michael Hoy, Chao Wang

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Safe Robot Navigation Among Moving and Steady Obstacles is the first book to focus on reactive navigation algorithms in unknown dynamic environments with moving and steady obstacles.

The first three chapters provide introduction and background on sliding mode control theory, sensor models, and vehicle kinematics. Chapter 4 deals with the problem of optimal navigation in the presence of obstacles. Chapter 5 discusses the problem of reactively navigating. In Chapter 6, border patrolling algorithms are applied to a more general problem of reactively navigating. A method for guidance of a Dubins-like mobile robot is presented in Chapter 7. Chapter 8 introduces and studies a simple biologically-inspired strategy for navigation a Dubins-car. Chapter 9 deals with a hard scenario where the environment of operation is cluttered with obstacles that may undergo arbitrary motions, including rotations and deformations. Chapter 10 presents a novel reactive algorithm for collision free navigation of a nonholonomic robot in unknown complex dynamic environments with moving obstacles. Chapter 11 introduces and examines a novel purely reactive algorithm to navigate a planar mobile robot in densely cluttered environments with unpredictably moving and deforming obstacles. Chapter 12 considers a multiple robot scenario.

For the Control and Automation Engineer, this book offers accessible and precise development of important mathematical models and results. All the presented results have mathematically rigorous proofs. On the other hand, the Engineer in Industry can benefit by the experiments with real robots such as Pioneer robots, autonomous wheelchairs and autonomous mobile hospital.

- First book on collision free reactive robot navigation in unknown dynamic environments
- Bridges the gap between mathematical model and practical algorithms
- Presents implementable and computationally efficient algorithms of robot navigation
- Includes mathematically rigorous proofs of their convergence
- A detailed review of existing reactive navigation algorithm for obstacle avoidance
- Describes fundamentals of sliding mode control

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