Hybrid Control and Motion Planning of Dynamical Legged Locomotion (IEEE Press Series on Systems Science and Engineering)

Nasser Sadati, Guy A. Dumont, Kaveh Akabri Hamed, William A. Gruver

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A much-needed, state-of-the-art guide on building complex legged robots

Robot control of dynamical legged locomotion has seen tremendous advances in recent decades, with hundreds of walking mechanisms being built in laboratories worldwide, helping people with disabilities and serving as replacements for humans operating in hazardous environments. This book addresses the need in the field for a comprehensive review of motion planning algorithms and hybrid control methodologies for complex legged robots.

Introducing a multidisciplinary systems engineering approach for tackling many challenges posed by legged locomotion, the book provides the engineering detail readers' need to achieve dynamical legged locomotion, including hybrid models for planar and 3D legged robots, as well as hybrid control schemes for asymptotically stabilizing periodic orbits in these closed-loop systems. Researchers and practicing engineers familiar with robotics and control systems will gain a thorough understanding of:

- Hybrid systems and systems with impulse effects
- Offline and online motion planning algorithms to generate periodic walking and running motions
- Two-level control schemes, including within-stride feedback laws to reduce the dimension of the hybrid systems
- Continuous-time update laws to minimize a general cost function online
- Event-based update laws to asymptotically stabilize periodic orbits

Complete with downloadable MATLAB code of the control algorithms and schemes used in the book, *Hybrid Control and Motion Planning of Dynamical Legged Locomotion* is an invaluable guide to the latest developments and future trends in dynamical legged locomotion.

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