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Maglev Trains

Key Underlying Technologies

Springer

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Preface

Maglev (derived from magnetic levitation) is a system of transportation that suspends, guides and propels vehicles, predominantly trains, using magnetic levitation from a very large number of magnets for lift and propulsion. In terms of the magnetism between magnets and magnetic components on the track, Maglev train is attracted to suspend above the track. The travel of train depends on the traction of linear motors in the vehicle. In order to ensure the safe operation of Maglev train, some key technologies must be adopted and realized, such as suspension and orientation technology, safe braking technology, position and speed detection technology, control and diagnosis technology. In the book, we present them and provide corresponding new technologies or ideas on control and diagnosis of Maglev train. We hope the contents of the book can provide some references and helps for the researcher, scholar, engineer on Rail Transit industry and Maglev technology.

The book comprises six chapters, covering about 200 pages. These chapters were written by Zhigang Liu, Zhiqiang Long and Xiaolong Li from Southwest Jiaotong University and National University of Defense Technology in China.

The book begins with an introduction of Maglev train. In Chap. 1, the characteristics and classification of Maglev train are presented. Some research and major achievements of Maglev train key technologies are discussed in detail. The technology characteristics of high-speed Maglev train and low-speed Maglev train are presented. Specially, the technology characteristics of TR08 Maglev train are discussed, and the overall design idea of TR Maglev train is outlined. In Chap. 2, the technology development and application research of Maglev control are discussed and summarized, mainly including suspension control plan and suspension control algorithms of Maglev train. Chapter 3 discusses the modeling and controller design of suspension system of Maglev train in detail. They mainly include building single point suspension model, design of control system, optimization of control parameters under the condition of output saturation, design of signal filter of suspension control system and experimental research. Chapter 4 discusses the control and diagnosis system of Maglev train, which mainly includes on-board control and diagnosis system, comprehensive assessment algorithm of on-board

faults based on fuzzy comprehensive assessment, and comprehensive assessment method based on EDA (estimation of distribution algorithm). In Chap. 5, the on-board control and diagnosis networks of Maglev train are introduced. Main contents include the communication simulation of on-board diagnosis network, integrated network design of the control and diagnosis networks, diagnosis network based on ADS, control and diagnosis networks based on role automation decentralization, and on-board communication platform in Maglev train based on RTLinux. In Chap. 6, the position and speed detection technology based on loop-cable for low-speed Maglev train is introduced and discussed in detail. Main contents include position and speed detection based on the XOR pulse, position and speed detection based on sampling, and experiments and system implementation.

One important feature of the book is that some new technologies or ideas on control and diagnosis of Maglev train are proposed and discussed. The experiments presented are real-life engineering problems, as well as problems that can be helpful to apply new techniques in Maglev train.

The studies reported in this book clearly indicate an increasing interest in Maglev train control and diagnosis technologies for real-life engineering applications. These studies are expected to simulate the interest of other researchers around the world who are facing new challenges in Maglev train and key technologies.

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