

Electrification of Heavy-Duty Construction Vehicles

Synthesis Lectures on Advances in Automotive Technology

Editor

Amir Khajepour, *University of Waterloo*

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Hong Wang, Yanjun Huang, Amir Khajepour, and Chuan Hu
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#1

ABSTRACT

The number of heavy-duty construction vehicles is increasing significantly with growing urban development causing poor air quality and higher emissions. The electrification of construction vehicles is a way to mitigate the resulting air pollution and emissions. In this book, we consider tracked bulldozers, as an example, to demonstrate the approach and evaluate the benefits of the electrification of construction vehicles. The book is intended for senior undergraduate students, graduate students, and anyone with an interest in the electrification of heavy vehicles.

The book begins with an introduction to electrification of heavy-duty construction vehicles. The second chapter is focused on the terramechanics and interactions between track and blades with soil. The third chapter presents the architecture and modeling of a series hybrid bulldozer. Finally, the fourth chapter discusses energy management systems for electrified heavy construction vehicles.

KEYWORDS

hybrid electric tracked bulldozer, terramechanics, system modeling, energy management, dynamic programming, model predictive control, hybrid energy storage system

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Preface

This book introduces the electrification of heavy duty construction vehicles. It provides working characteristics and electrified configuration of heavy-duty construction vehicles and also their energy management systems. The book is intended for engineers in construction vehicle companies striving to develop an electrified vehicle and graduate and senior undergraduate students in mechanical and automotive engineering. This book is also accessible to anyone interested in learning about the electrification of heavy-duty construction vehicles. It uses a step-by-step approach using pictures, graphs, tables, and examples so that the reader can easily grasp difficult concepts.

After a short introduction, the terramechanics of a heavy-duty construction vehicles is presented. The architecture of the electrified heavy-duty construction vehicle and modeling of a series hybrid vehicle are introduced. Energy management systems for electrified heavy-duty construction vehicles are discussed and developed. The book ends with conclusions and references.

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