

# Smart Charging and Anti-Idling Systems

# Synthesis Lectures on Advances in Automotive Technology

Editor

**Amir Khajepour**, *University of Waterloo*

The automotive industry has entered a transformational period that will see an unprecedented evolution in the technological capabilities of vehicles. Significant advances in new manufacturing techniques, low-cost sensors, high processing power, and ubiquitous real-time access to information mean that vehicles are rapidly changing and growing in complexity. These new technologies—including the inevitable evolution toward autonomous vehicles—will ultimately deliver substantial benefits to drivers, passengers, and the environment. Synthesis Lectures on Advances in Automotive Technology Series is intended to introduce such new transformational technologies in the automotive industry to its readers.

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## ABSTRACT

As public attention on energy conservation and emission reduction has increased in recent years, engine idling has become a growing concern due to its low efficiency and high emissions. Service vehicles equipped with auxiliary systems, such as refrigeration, air conditioning, PCs, and electronics, usually have to idle to power them. The number of service vehicles (e.g. public-school-tour buses, delivery-refrigerator trucks, police cars, ambulances, armed vehicles, firefighter vehicles) is increasing significantly with tremendous social development. Therefore, introducing new anti-idling solutions is inevitably vital for controlling energy unsustainability and poor air quality. There are a few books about the idling disadvantages and anti-idling solutions. Most of them are more concerned with different anti-idling technologies and their effects on the society rather than elaborating an anti-idling system design considering different applications and limitations. There is still much room to improve existing anti-idling technologies and products.

In this book, we took a service vehicle, refrigerator truck, as an example to demonstrate the whole process of designing, optimizing, controlling, and developing a smart charging system for the anti-idling purpose. The proposed system cannot only electrify the auxiliary systems to achieve anti-idling, but also utilize the concepts of regenerative braking and optimal charging strategy to arrive at an optimum solution. Necessary tools, algorithms, and methods are illustrated and the benefits of the optimal anti-idling solution are evaluated.

## KEYWORDS

anti-idling system, auxiliary-system electrification, powertrain modeling and sizing, working-condition prediction, power management strategies, dynamic programming, AECMS (adaptive equivalent fuel consumption minimization strategy), model predictive control

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