

Electric & Hybrid Car Tuning and Maintenance: Engineering Principles, Performance Upgrades, and Long-Term Reliability

Future of Automotive Engineering Series, Volume 3

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MAINTENANCE: ENGINEERING PRINCIPLES,
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RELIABILITY

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Long-Term Reliability*

Preface

THE GLOBAL AUTOMOTIVE landscape is undergoing one of the most profound transformations in its history. For more than a century, the internal combustion engine defined mobility, industry, and even culture. Yet today, the growing urgency to reduce emissions, preserve natural resources, and lower the cost of transportation has shifted attention toward electric and hybrid vehicles.

This transformation is not simply about replacing gasoline with electricity. It represents a broader movement toward energy efficiency, environmental responsibility, and smarter mobility. Governments worldwide are setting ambitious targets to phase out fossil fuel cars, manufacturers are investing billions into battery technologies, and infrastructure for charging and clean energy is expanding at unprecedented rates.

Beyond environmental benefits, electric and hybrid vehicles offer clear advantages to the everyday driver: lower operating costs, fewer moving parts to maintain, and reduced dependency on expensive fuels. They are quieter, cleaner, and in many cases, more responsive than their gasoline counterparts. At the same time, hybrid technology bridges the gap by combining traditional engines with electric power, delivering both extended range and fuel savings.

Still, these vehicles are not free from challenges. Battery health, charging cycles, high-voltage systems, and unique maintenance

requirements present new learning curves for car owners and enthusiasts alike. My aim with this book is to demystify these technologies, explain how they work, and provide practical knowledge to maintain, optimize, and even enhance them.

Just as I explored performance, safety, and customization in my earlier book on car tuning, this work focuses on the unique realities of electric and hybrid systems. Whether you are a first-time EV owner, a hybrid driver curious about extending vehicle life, or an enthusiast considering how to optimize efficiency and performance, this guide will help you navigate the transition with confidence.

The automotive world is changing rapidly. By understanding the technology, we not only adapt to it—we take full advantage of its promise. This book is an invitation to explore that future.

— *Mohammed Hamed Ahmed Soliman*

Author's Note

CARS HAVE BEEN MORE than machines to me—they are dynamic systems that blend mechanical precision, electrical innovation, and human interaction. My journey began with a lifelong passion for driving and tuning cars, exploring how every adjustment, every upgrade, and every component affects performance and safety.

Professionally, I hold a robust background in **Mechanical Engineering** and have expanded my expertise into **Industrial Engineering and Systems**, serving as a lecturer at a leading university. This combination of hands-on experience and formal academic training allows me to approach vehicle performance and maintenance with both rigor and practicality.

Over the years, I have engaged deeply with automotive technologies, from internal combustion engines to modern electric and hybrid systems. My experience spans **vehicle design, diagnostics, powertrain optimization, and industrial process management**, giving me a unique perspective on how vehicles operate under real-world conditions.

This book represents a synthesis of my **practical tuning experience, academic insight, and commitment to engineering excellence**. It is written for enthusiasts who want to understand the science behind the systems they work on,

and for professionals who seek reliable guidance on EV and hybrid maintenance, performance, and safety.

For readers of my previous books on ICE tuning, this volume provides a natural continuation, bridging traditional performance knowledge with the challenges and opportunities of electric and hybrid vehicles. My goal is to equip every reader with the understanding, confidence, and tools necessary to **optimize, maintain, and enjoy modern vehicles safely and efficiently.**

— **Mohammed Hamed Ahmed Soliman**

Chapter 1 – The Future of Automotive Engineering

