

Preface

As already realized by the general community, the electrification of passenger cars has increased significantly over the past ten years, starting with micro-hybrid cars, which provide start-stop systems and limited energy recovery from braking, and going over to mild and full-hybrid electric vehicles, as well as full electric cars. This trend of growing electrification also occurs in the segment of heavy-duty vehicles and long-haul trucks.

The sociopolitical pressure for higher energy efficiency of on-road vehicles will also be imposed on non-road mobile machinery in the foreseeable future. Increasing energy prices will also enhance the economical motivation to go for higher energy efficiency. Any additional costs due to the energy efficiency increase of mobile machinery, which are usually counted as assets, need to be compensated by reduced fuel consumption or increased productivity, though. An environmental sustainability life cycle analysis requires therefore to include the resourcing, production, results of application, and the component disposal after lifetime to see if the energy efficiency increase is reasonable by ecological aspects.

Therefore, the conclusion to achieve a positive life cycle leads to the fact that any additional components of the hybrid powertrain and their degrees of freedom are used in the best way. This goal is the key topic of the book!

In comparison to on-road vehicles, the spectrum of load profiles of the powertrain is significantly larger and more dynamic for mobile machinery applications. The usual load profile is not only obtained by the drivetrain, but also by auxiliary equipment such as oil pumps, e.g., for lifting a bucket. On the other side, the total number of vehicles is much smaller and, therefore, development costs are more expensive.

A generic energy management, which is capable of controlling a wide range of totally different applications at an optimum, is presented to meet the requirements for non-road mobile machinery. Without any change to energy management software, the operation strategies such as torque split for maximum energy efficiency, phlegmatization, downspeeding, constant speed, and stationary operation may be changed between each other for flexibility reasons.

Cycle detection and load prediction, as presented in the book, provide further information for energy management, which help to operate the hybrid powertrain more on the optimal operation point and closer on the feasibility limit. In this context, the battery charging status needs to be known with high accuracy, but is not measurable online during operation. For this purpose, a generic methodology has been developed to identify battery dynamics automatically; it is independently applicable to any battery chemistry.

This book discusses several different sectors of technology and highly sophisticated engineering, but it should not be seen as a general reference or as a fundamentally educational book. It is more a book of detailed research content that can be used for implementation into given problem sets as well as a reference for different methodologies applicable to any other fields.

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