

Preface

This edited book, *Handbook of Camera Monitor Systems—The Automotive Mirror-Replacement Technology based on ISO 16505*, aims to provide a comprehensive overview of the science and technology of camera monitor systems (CMS). The content ranges from the ISO 16505-based development aspects to practical realization concepts in vehicles. In addition, it serves as a single reference source with contributions from leading international CMS professionals and academic researchers combining technological as well as ergonomic aspects. Most of the authors, including the editor, have been involved in the international standardization and regulation of this technology over the past years.

The replacement of automotive mirrors by CMS is a growing research and development field. Such systems can be used to improve factors in the driver's indirect vision, to improve aerodynamics, and to optimize the fuel economy of new vehicles. The CMS idea has existed for concept cars for decades, but until now there was no international legislation framework for such solutions in series production vehicles. The first milestone was the publication of the international standard ISO 16505 "Road vehicles—Ergonomic and performance aspects of Camera Monitor Systems—Requirements and test procedures" in the year 2015. In combination with the latest version of UN Regulation No. 46, the normative framework of ISO 16505 permits CMS to replace mandatory rear-view mirrors. Working on CMS requires specific knowledge of the technical fundamentals, standardization and regulation aspects, as well as specific automotive requirements and the relevant ergonomics. Although literature exists which covers subtopics, e.g., automotive camera technology, until now no text combining all the required disciplines in one special book dedicated to CMS exists. Furthermore, methods and results for the ergonomic design of such systems are included.

The book is organized into five parts.

Part I "CMS System Design and Standardization and Regulation Aspects" is dedicated to the system design of passenger as well as commercial vehicles. It includes a contribution covering the CMS-specific standardization and regulation

aspects. A key topic of CMS, which is addressed by a special contribution, is the resolution and the sharpness of the complete system.

Part II “Fundamentals of Automotive Technology for CMS” covers the relevant fundamentals of automotive imagers, video interface technology, and embedded image processing components. All contributions present the content with regard to CMS. The optical effects in camera monitor systems in combination with optical measurement setups are presented in a special contribution.

Part III “Human Visual Perception and Ergonomic Design” starts by presenting the properties of human visual perception with respect to CMS. It includes contributions covering the ergonomic design of CMS for the very demanding commercial vehicles scenario.

Part IV “CMS Tests and Concepts for Passenger Cars and for Commercial Vehicles” includes a study comparing CMS and conventional exterior mirrors and which made its assessment using test drives and static tests under different external conditions. It is a unique text covering these aspects with respect to the ISO 16505 and UN R.46 requirements. The German Federal Highway Research Institute (BAST) carried out this study on behalf of the German Federal Ministry of Transport and Digital Infrastructure. A contribution with concepts for commercial vehicles is also included in this part of the book.

Part V “Advanced Topics” provides content with direct or indirect relevance to CMS. It begins with a discussion of demanding scenarios in CMS and includes image-quality criteria. A special contribution presents a novel approach for intuitive motion and depth visualization for rear-view camera applications. The book concludes with a dedicated contribution to the very important functional safety aspects of CMS based on ISO 26262. It explains what hazards could arise in the context of CMS and how they can be systematically investigated.

Handbook of Camera Monitor Systems

The Automotive Mirror-Replacement Technology based
on ISO 16505

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