

Preface

The performance, handling and comfort of an automobile are significantly affected by its aerodynamic properties. A low drag is a decisive prerequisite for good fuel economy. Increasing fuel prices and stringent legal regulations ensure that this long-established relationship becomes more widely acknowledged. But the other aspects of vehicle aerodynamics are no less important for the quality of an automobile: side wind stability, wind noise, soiling of the body, the lights and the windows, cooling of the engine, the gear box and the brakes, and finally heating and ventilating of the passenger compartment all depend on the flow field around and through the vehicle.

Vehicle aerodynamics is still an empirical science, if not an art. Whereas other technical disciplines such as aeronautics, naval architecture and turbomachinery are governed by well-established theoretical and experimental methods of fluid mechanics, no consistent design procedures are yet available for road vehicles. The complexity of the flow field around a car, which is characterized by separation, must be blamed for this lack, and this means that the vehicle aerodynamicist must refer to a large amount of detail resulting from earlier development work. His success depends on his ability to transfer these results to his own problem and to combine results originating from many different earlier developments to a consistent solution.

It is the intention of the present book to introduce the vehicle engineer to this approach. His interest is focused on three aspects:

- the fundamental of fluid mechanics as related to vehicle aerodynamics;
- the essential experimental results, presented as ground rules of fluid mechanics and brought to general validity wherever possible;
- design strategies, showing how many existing single results can be combined to provide general solutions.

The aerodynamics of passenger cars, commercial vehicles, sports cars and race cars is dealt with in detail. Not only the external flow field is covered; the problems of the several internal flow systems are treated as well. Because the external and the internal flow fields are interrelated, both have to be considered at the same time. The related test techniques are described in detail, emphasizing the correlation between the wind tunnel, which is the main tool of the vehicle aerodynamicist, and the road,

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which is the real world for the car in a customer's hands. A chapter on numerical methods concludes the book. Although theoretical models are still of limited evidential value they are more and more used for guiding and supporting, rather than replacing, wind tunnel tests.

The first German edition of this book was originally based on a course given by the authors at the 'Haus der Technik', Essen, Germany, under the aegis of Dr H. Hahn. This English version is a completely revised second edition. It is intended for vehicle engineers in industry and research, at universities and in administrative departments. But it is also aimed at stylists and designers, students and professional writers in the car world. Detailed knowledge of fluid mechanics is not assumed. The chapter on the fundamentals of fluid mechanics provides the reader with the necessary details.

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