



# **The Automotive Body Manufacturing Systems and Processes**

**Mohammed A. Omar**

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**Mohammed A. Omar**

*Clemson University International Center for Automotive Research CU-ICAR, USA*



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To Rania and Yanal, my sources of inspiration.

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# Preface

This book addresses the automotive body manufacturing processes from three perspectives: (1) the transformational aspect, where all the actual material conversion processes and steps are discussed in detail; (2) the static aspect, which covers the plant layout design and strategies in addition to the locational strategies; and, finally, (3) the operational aspect. The transformational aspect is discussed in Chapters 2, 3, 4, 5, and 6; while the static aspect is given in Chapter 7 and the operational aspect with its two different levels—operational and strategic—is presented in Chapter 8.

The transformational perspective starts by covering the metal forming practices and its basic theoretical background in Chapter 2. It also addresses the potential technologies that might be used for shaping and forming the different body panels using lightweight materials with a lower formability window, such as aluminum and magnesium. The text discusses the automotive joining processes in Chapter 3, covering the fusion-based welding technologies, mainly the metal inert gas (MIG), the tungsten inert gas (TIG), and the resistance welding practices. These welding technologies are discussed to explain their applicability and limitations in joining the different body panels and components. The welding schedules for each of these technologies are explained and the spot-welding lobes and dynamic resistance behavior are also explained. Additionally, Chapter 3 describes the adhesive bonding practices and the different preparations and selection process needed to apply and decide on the correct adhesive bonds. The different strategies applied by automotive OEMs to enable their welding lines to accommodate different body styles using intelligent fixtures and control schemes are also discussed. Finally, the robotic welders and their advantages over manual applications, in addition to discussing potential joining practices such as friction stir welding, are addressed in this chapter.

Chapter 4 discusses the automotive painting processes and its different steps; starting from the conditioning and cleaning, then the conversion and E-coating, followed by the spray-based painting processes. Also, this chapter describes the automotive paint booths' design and operation, while addressing the difference between the solvent-borne, and power-coat-based booth designs. Other miscellaneous steps that include the sealant, PVC and under-body wax application and curing steps are presented. In Chapter 5, the final assembly area and the different processing applied to