Preface

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The evolution of the modern vehicle tends to safety, comfort, and energy consumption. Vehicle body engineering plays an important role in the evolution of the entire vehicle. It includes exterior and interior design. It is also a multidisciplinary field that covers art, engineering, computer science, and psychology. The main topics involved in vehicle body engineering are vehicle styling, aerodynamics, materials, methods of design and manufacturing, occupant comfort, and safety. This special issue focuses on new research and advances in vehicle body engineering for automobile, aircraft, spacecraft, etc. It includes 12 papers that span various aspects of research on vehicle body engineering. The papers can be summarised as follows.

Chang and Hwang have developed a new scheme for vehicle ride-comfort analysis based on electroencephalogram (EEG) data. Experiments were carried out using a test course with simultaneous recording of subjects' brainwaves. Results derived from the subjects' answers to a sensory questionnaire were also analysed. The correlation between the brainwaves and sensory evaluation proved the feasibility of the application of EEG analysis to ride-comfort evaluation.

Pan and Zhu present a multiple surrogates based optimisation methodology to select the best accurate one from a set of surrogate models for each response during iterative optimisation process. The importance of design variable was also identified based on Sobol's method. The results reached weight savings of 4.14 kg (17.1%) without compromising the considered performances.

Gragg et al. have developed an optimisation-based method to determine the seat adjustment range without the need for population sampling and stochastic posture prediction. Boundary anthropometric digital human models, a 95% male and a 5% female, were used to establish the driver seat adjustment range for vehicles. The simulation predicts the optimum posture of the seated driver inside the vehicle, and also gives an indication of how comfortable the driver is while seated in the predicted posture.

Lin et al. have determined the ride comfort qualities of three different Sport-Utility Vehicles (SUVs) using sensors, road data acquisition, and road load simulation in the laboratory via road and bench tests. Three road types, three driving speeds and one drive file were used. The point vibration total value and Overall Vibration Total Value (OVTV) based on the root mean square of the acceleration in the ISO 2631 standard and the Seat Effective Amplitude Transmissibility (SEAT) value were evaluated to compare the ride qualities of three SUVs. This allows for a fast and objective evaluation of ride comfort using bench tests with a correction factor.

Gao and Sun present multiple optimisation methods in different stages of vehicle body design. Firstly, finite element analysis is carried out for original model, which provides the base value for evaluating the performance. Secondly, topology space is constructed according to the structure and arrangement of front auto body, and topology optimisation is made under the combination of multiple load cases. Thirdly, size optimisation is done for original design under multiple load cases.

Jin et al. propose a three-phase optimisation design method for an electric car body at conceptual design stage. It is composed of two steps of topology optimisation and one step of size optimisation, and used for design of a mini electric car body in white at conceptual design stage. The method provides an opportunity to comprehend performances of the body construction under different load conditions in detail. Final result of the optimised body in white achieves 31% weight reduction with improved stiffness, strength and the first order frequency compared with previous design.

Calabrese presents the structure and transformation of the Italian car styling supply chain.

Barari has studied the two concerning uncertainty sources including measurement planning and minimum deviation zone evaluation processes. Using simulation of inspection processes on a typical car-body component, the significance of computational uncertainties is studied. It is shown that the effect of studied uncertainties can make at least the same contribution of the other uncertainty sources of coordinate metrology.

Hou et al. have developed a rapid structural property evaluation system, named the VCD system, in order to estimate rapidly the structural property of car body in advanced design phase. In the system, the parametric frame model of car body in white was built by the method of template. The beam element was adopted to constitute a flexible FEM analysis model. The database of parametric section of body was built to store sections with real shape and joint element was used to simulate the joint in the body which would improve the precision of model body.

Yao et al. have developed a Finite Element (FE) model of the Chalmers-Autoliv pedestrian dummy as an evaluation tool for the design of pedestrian friendly vehicles in addition to the EEVC pedestrian subsystem tests. The dummy model consists of a head, neck, thorax, pelvic, thighs, legs, feet, jacket and shoes.

Mavuri and Watkins have developed a relatively simple two-wheeled body to reproduce front and rear wheel effects of a typical four wheeled passenger car. Benchmarking experiments were performed in a wind tunnel using a double-symmetry experimental testing concept. CFD techniques were used for parametric study and analysis of wheel-housing geometry of a generic test vehicle.

Xu et al. present a model of a cab-operator and isolating mount system and determined the system's natural frequency and percentage kinetic energy distribution. The optimisation design to achieve the desired natural frequency range and minimise the motion coupling at each mode is introduced. The results of a case study demonstrate that suitable mount locations and rubber mount stiffness could bring out the required natural frequency and lowest mode coupling.

It is a great honour to serve as guest editors for this special issue on Research and Advances in Vehicle Body Engineering. We would like to thank all the authors and reviewers for their time and efforts to make this special issue possible.