

**ACP OPDESIGN SOFTWARE, A GATEWAY TO  
OPTIMIZATION, LIGHTWEIGHTING  
AND OPTIMIZATION-LED DESIGN**

**Dr. Akbar Farahani, VP of Global Engineering, ETA, Inc.**

**Alexandros Kaloudis, Application Solutions Manager, BETA CAE  
Systems SA**

**Dr. Morteza Kiani, Technical Specialist, ETA, Inc.**

**Divesh Mittal, ACP Lead Engineer, ETA, Inc.**

**KEYWORDS**

Lightweighting, product development, optimization-led design, ACP OpDesign, ACP Process, multidisciplinary performance, advanced materials, mass reduction, 3G Optimization.

**ABSTRACT**

Lightweighting is a major focus currently in the product design and development of structures, such as ground transportation vehicles (passenger cars, trucks and buses) and other consumer products. Lightweighting is a multipurpose economical solution for many industries including environmental, construction, and transportation. A few examples of how lightweighting affects product design and development include a reduction of product costs, a reduction of Co2 (34.1 MPG 2016 to 54.5 MPG by 2025), a reduction in shipping costs and a reduction in transportation costs.

Lightweighting, for OEMs and suppliers is an uphill battle, in which they must design and produce products that require a balance between a variety of competing factors such as cost, mass, multidisciplinary performance, multimaterial function, joining and manufacturability. Furthermore, they must achieve this balance while meeting high government and consumer standards.

Multimaterial products for lightweighting, are the future of product design and development for Electric Vehicles (EV) and Battery Electric Vehicles (BEV). One of the most difficult tasks for manufacturers is the proper use of materials, the choice of advanced materials (Advanced High Strength Steel, Aluminum and Carbon Fiber Plastic), placed in the

proper location, with the optimal geometry, optimal grades and optimal gauges. To assist OEM's and suppliers in addressing these challenges, in 2015 ETA and BETA CAE joined forces to create a software product called "ACP OpDesign". It offers a systematic process for product design and development and lightweighting, based on ETA's patented ACP Process technology.

ACP OpDesign is an optimization-led design tool, used from the concept level to the manufacturing stage based on the Accelerated Concept to Product (ACP) Process®. The process orchestrates and drives the maturity of a product from the concept phase, to its near production stage for manufacturing. Allowing multidisciplinary loading (linear and nonlinear), it searches for the optimal material types and best Geometry, Grade and Gauges (3G optimization). ACP OpDesign is designed based on ANSA and META (developed by BETA CAE Systems) and acts as a Gateway to Optimization (Topology, Parameteric, Shape, Size, Topometry, Topography, MDO, Robustness and Total System) using multi-function commercial optimization softwares (LS-TaSc, GENESIS, Tosca, LS-Opt, ModeFrontier, I-Sight and HEEDS). Also, provide a unique process to drive design from concept to detail design using optimization.

The presentation will give an overview of the FutureSteelVehicle body in white (Developed by WorldAutoSteel) for a battery electric vehicle, resulting in a 39% mass reduction. The overview of the FSV design from the concept stage (packaging and styling) to the Low Fidelity Design Concept (LFDC) will be presented using ACP OpDesign. New technology will be explored to show how it enhances and simplifies the process. The technology reduces the resource requirements and reduces product development time to market, by leveraging the many processing tools built within its software platform ANSA.

Using this systematic method, ACP OpDesign creates a balance between structure and strength, synchronizing the individual facets of the product development process. The advantages include design efficiency, shorter product design and engineering time, lower project costs and provides a unique database for product design and development Life Cycle Management.