



RENAULT

OPTIMIZATION OF PRODUCT DESIGN



Objectives:

- Calculate the optimal size of complex systems required to meet the criteria concerning resistance, safety, cost, CO2 emissions, etc. used to design Renault vehicles
- Help shorten the design cycle



Solution:

- ALTERNOVA, an optimization software suite for product design
- Conceptual designs made by Eurodecision for management in Renault business units



Results:

- Designs that meet the requirements in the specifications (e.g. weight reduction, improved shock absorption, etc.) and are delivered on time
- Optimization studies are carried out systematically during vehicle projects

“This was a win-win operation for both partners. By combining our know-how, we have obtained a tool with a good technical level that delivers concrete results. Eurodecision's key strength is its ability to use and support our project teams. Moreover, we were able to perpetuate this collaboration”. Yves Tourbier, Manager of the Optimization and digital methods group at the Renault Research Department

Context

The Renault Research Department has worked with Eurodecision since 2005 to conceive and develop a design optimization software suite. This platform, called ALTERNOVA, is now used by Renault and Eurodecision teams to meet the various needs of the Vehicle Engineering Department, notably concerning “painted body engineering”, where it is vital to optimize the balance between the structure's weight and its services.

An example of Renault's DICAP¹ application

The tool has been used to optimize the body structure for Renault vehicle projects since the Laguna III.

Design choices concern the thickness of parts and their steel grades, whether bracing is used, and various architectural options. These choices are evaluated for various services, mainly behaviour in the event of a crash (front, rear, side) and for reducing vibrations. The goal of the analysis is to reduce the body weight while complying with the specifications defined for each service.

The body optimization studies involve between 30 and 200 design parameters of about 100 parts. It is increasingly common to include shape parameters, used to explore more technical solutions.

The weight reductions obtained, with identical performance, are generally 5–15% of the weight of the modified parts. Reductions on the order of 25% were obtained for smaller part assemblies, plastic parts in particular.

By automating the calculation processes—including shape modifications—Renault divided the time required for optimization designs by a factor of three.

Studies with a larger scope are also carried out on a “research” basis. They are intended to increase the overall gain for the vehicle project, not only for the sub-assemblies which may have competing objectives. The body interacts with other parts of the vehicle: the seats, the steering column crossmember, shock absorbers, body equipment, front and rear ends.

Assessment and outlook

ALTERNOVA is used at various steps in the vehicle project: initially to make architectural choices concerning the structure, and then during the design phase to size the sub-assemblies.

Besides the assembled and painted body, Eurodecision works with the Vehicle Engineering Department in other fields concerning body parts such as plastic wings, the steering column crossmember, seats, etc..

Studies are also carried out for vehicles targeting markets outside Europe which do not use the same types of steel and do not have the same constraints, e.g. concerning safety.

The goal to reduce CO₂ emissions is currently a top priority, and weight is a key factor. All manufacturers are seeking to reduce weight by 10–15% for future versions of their vehicles. Yet weight is the most difficult variable to optimize because it represents the quantity of materials used by designers.

ALTERNOVA is constantly being improved. Current efforts focus on configuring shapes and developing applications dedicated to specific industry issues.

Eurodecision, which works directly on Renault vehicle projects, also provides employee training on ALTERNOVA.

Today Eurodecision is authorised by Renault to expand the community of ALTERNOVA users. It can offer the tool's services in other application areas such as engineering projects for railways or vehicle wiring harnesses.

¹ DICAP: Painted Body Engineering Department