AUTOMATED OPTIMIZATION OF A CAR EXTERNAL AERODYNAMICS FOR AERO-DRAG REDUCTION.

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ABSTRACT –
The study of the external aerodynamics is a crucial topic during the design process of each car model. Good aerodynamics means good vehicle performances and low fuel consumption. In particular, the last issue is very important nowaday because it is strictly tied with pollution and environment depletion.
In order to reduce vehicle fuel consumption, aerodynamic resistance has to be reduced. Computational Fluid Dynamics (CFD) is widely adopted in vehicle aerodynamics development today, but typically used to study one vehicle shape at a time. In order to be used for aerodynamic shape optimization the CFD simulation process has to be able to study a large set of design alternatives, within the short period of time available in the design stage. A study was carried out to establish an automated optimization process applied to external aerodynamics of a real-life vehicle model, particularly focusing on the methodology. The aim of the research is to obtain a performance improvement in terms of drag reduction through the definition and variation of specific vehicle shape parameters, using ANSA pre-processor mesh morphing techniques. Several parameters configurations are obtained based on the design of experiments (DOE) matrix purposely created by OPTIMUS. Within the simulation loop, vehicle shape variants are generated by ANSA and analysed by Star CCM+. Then, an interpolating model is defined and optimized in order to find the parameters configuration allowing the minimum drag. Through this process it is possible to explore in a small period of time a large number of shape variants to evaluate the influence of different parameters of the vehicle on overall resistance to motion. So, it constitutes a predictive tool in the design phase of a new vehicle.