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# General model for automatic design optimisation of aerodynamic components. Wind tunnel case study

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**Abstract-**

**Trial and error is still the current approach for the design of many complex aerodynamic components, although extensive research is being carried out in automated optimisation methods. Thereafter these designs are computer simulated using Computational Fluid Dynamics (CFD). Some optimisation tools are used, at most, for the final fine-tuning. This paper proposes the use of a robust, efficient and automated optimisation methodology throughout the whole design process. The use of these methodologies can yield improved yet not conventional designs, while reducing the design cycle time. This paper presents the development of an original, general methodology based on a multi-attribute, structured optimisation, following a so-called Hybrid Direct Search (HDS), which combines genetic, gradient and swarm search intelligence. An example case study of a wind tunnel shape optimisation is presented. The main contributions of this paper are the exploitation of the concepts of variable hierarchy and variable value change (i.e. optimisation phases) and the HDS optimisation method, which allows for an intelligent and efficient direct search in complex aerodynamic problems in which the use of surrogate based optimisation is not accurate enough. This optimisation methodology is applicable to advanced aerodynamic design in cars, aircraft, high-speed trains, etc. You can download the paper here: http://www.revistadyna.com/Articulos/Ficha.aspx?Cod=8144&CodArt=5A8731E5-40C2-4D00-9537-B05B4797A641**

**Index Terms- erodynamic optimisation, wind tunnel design, optimisation methodology, multi-attribute, structured optimisation, hybrid direct search, swarm search, variable hierarchy, geometry parameterisation, computational fluid dynamics.**



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