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## Automatic shape and topology variations in 3D CAD environments for genetic optimisation

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**Abstract:** This paper introduces tools for automatic shape and topology variations in 3D-CAD environments for optimisation and innovation purposes. It is known that performance enhancements are first achieved through optimisation methods for finding maxima or minima of the response surface. Then, after performance enhancements through parametric changes are exhausted, paradigm shifts and other qualitative changes that lead to innovation are required. A macro has been implemented within a commercial CAD system as an approach for supporting shape and topological variations. Using genetic algorithms evolutionary shape and topology variations are performed that allow further performance enhancements.

**Keywords:** shape and topology optimisation; genetic algorithms; design automation; CAD; CAI; TRIZ.

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## 1 Introduction

Contemporary designers are faced with the dilemma of having to ensure design tasks in a context where the tools and methods available to assist them were developed within a framework of optimising quality, as imposed in the 1960–1990s. This means they are not always adapted to meet the requirements of current design tasks that are more

focused on optimising creative potential (Cavalucci and Leon, 2004).

It is known that commonly product performance enhancement is first achieved through quantitative changes in parametric design looking for optimisation. Later, as the performance enhancement through optimisation is exhausted, new searches are performed through paradigm