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NEW METHODOLOGY FOR DESIGNING DIRECT-LASER-SINTERED MOTORCYCLE FRAME BASED ON COMBINATION OF TOPOLOGY OPTIMIZATION AND LATTICE IMPLEMENTATION

THANH BINH CAO & SLAWOMIR KEDZIORA

Research Unit in Engineering Sciences, University of Luxembourg, Luxembourg

ABSTRACT

The use of direct laser sintering (DLS) has become more attractive recently since it offers a promising tool in fabricating complex components rapidly. Particularly, the technique is seen more powerful when it is combined with computer-aid design and computational optimization. In spite of knowledge increment in the above areas presently, design method for sophisticated structures towards DLS is still far from being fully exploited. Therefore, this paper was issued to investigate a novel methodology of design, developed by combining topology optimization and lattice-beam implementation, for a blend-solid-lattice frame of a motorcycle. From the obtained results, it was recognized that the as-built tubular hybrid structure demonstrated comparable values of first resonant frequency and mass with respected to those of the original. Additionally, it was found that stiffness of the generated structures depended strongly on locations where lattice was substituted. In particular, less stressed frame's components were evidenced as appropriate regions for the substitution. The achieved results also revealed estimated buckling load factors, being circa 18 times higher than applied bumping loads acted on the tubular-lattice structure. Finally, equivalent stress predicted in static analyses confirmed all designs working safely in nominated conditions. Based on these achievements, it is believed that the new method worked quite acceptably in designing direct-laser-sintered motorcycle frame, and it is very promising to further develop the method as well as extend it into different complex direct-laser-sintered elements designed for future applications.

KEYWORDS: CAD/CAE, FEA, Direct Laser Sintering, Topology/Lattice Optimization