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NEW INNOVATIVE LIQUID FUELED ROCKET MOTOR MANUFACTURING METHODS: ADDITIVE MANUFACTURING IN HIGH STRESS APPLICATIONS

Abstract

Additive manufactured components have come a long way in recent years, but are still only limited to sub-critical aspects. The author, in cooperation with the Royal Melbourne Institute of Technology's Advanced Manufacturing Precinct are investigating the advantages and disadvantages of using additive manufacturing techniques to construct a regeneratively cooled liquid bi-propellant rocket motor, built in a single piece. Through the use of 3D printed micro-trusses, the cost, manufacturing time, and dry mass can all be significantly reduced, while also increasing the cooling efficiency and the overall propulsion system efficiency.

Using traditional manufacturing techniques, ultimately the complexity of the part is limited by the capabilities of the machine on which it is made. Now however, using additive techniques the part complexity is only limited by the creativity of those designing it. When this technique is taken and applied to an already highly complex part, such as a regeneraltively cooled rocket motor, the possibilities for improvement and optimisation are immense. That stated, there still are a number of issues in additive manufacturing that limit the usefulness of parts made with additive methods.

Taking into account the positive and negative aspects of additive manufacturing, it has been possible to model and verify through experiment the behaviour of complex parts made with additive manufacturing under both high thermal and normal stresses. The resulting efforts have made way for the design and build of a scaled motor, proving the viability of the method in larger scale production.