A DESIGN–VALIDATION-PRODUCTION WORKFLOW FOR AEROSPACE ADDITIVE MANUFACTURING

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ABSTRACT

The aerospace industry is implementing 3D printing (additive manufacturing) on a selective basis for one-off and small production runs, often producing parts that cannot be made using conventional manufacturing processes. With 3D printing, there is an incredible capability to build a solid model, optimize its shape using FEA, and then print to make a ready-to-use part. The critical step is to ensure that the part will perform as simulated. This study uses Optistruct and Hyperstudy to simulate and optimize the design of a printable aluminium bellcrank.

To bolster confidence in the simulation of the designed part, an open loop validation of a different, standardized geometry is performed. The torsional crank uses the same elastic-plastic piecewise (matx36) material model and Optistruct for the simulation. Through the use of digital image correlation (DIC), images of the strain field on the face of the crank are gathered to compare to the simulated strains to evaluate fidelity of the simulation to the measured data. For this study, we also will record the strains while deforming the optimized part for the comparison of the variation between the two simulations. Incorporating this validation technique into the production workflow could bring confidence in the accuracy of the product simulation by testing the efficacy of the solver and material model before manufacture.