From Concept to Certified Production Component: Topology Optimization + Additive Manufacturing

Promise vs. Reality

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ABSTRACT

The advent of metal additive manufacturing (AM) has revived the interest in topologically optimized design. The combination of these two technologies has changed the design paradigm of industrially realizable products allowing for new freedom. However significant challenges remain in achieving the full potential of these technologies for end-to-end product development. This talk takes a look at those challenges, promising technologies that appear to be poised to close the current gaps, and areas that are not getting enough attention from industry and researchers alike.

A topology optimization algorithm without practical manufacturing constraint often produces organic appearing structures that are not producible by any manufacturing method, even additive manufacturing. Design for additive manufacturing intelligence improves success rates for nontrivial geometries to allow for the part to be successfully built and post processing steps such as depowdering and hipping to be economically accomplished. Simulation tools can predict build issues while still in the design stage, which can drive topology optimization away from failure prone designs with severe distortions and fatal part cracking.

Certification of produced parts free from fatal defects has been expensive, but tools such as industrial CT scanning make it possible to compare as designed to as built within a reasonable factor of confidence.

Limitations to large scale industrial adoption of topology optimized and additively manufactured components include lack of complete additive manufacturing design constraints, design for inspection intelligence, concurrent multiphyics design capabilities and automated certification capabilities.

REFERENCES

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