Computational Methods for Rapid Certification

When bringing a new product to market, often the most costly and time-consuming step in the process is certification. Sometimes, the entire process—which usually involves developing several prototypes and multiple physical test certification cycles—may be abandoned because the risk of failure is too high to justify the investment. Certifying a product while in the design phase, then immediately fabricating it for final testing, would greatly reduce development time and cost. Digital manufacturing may soon make this possible.

Today, high-quality parts suitable for critical applications can be conceptualized using computer-aided design tools, uploaded to additive manufacturing equipment, and built layer by layer. Soon, by collecting data about the digital design and manufacturing process and then coupling the data with robust predictive modeling and simulation tools, "rapid certification" will be possible. This advance will be crucial, since inserting a single materials system into a complex design can add millions of dollars and years of effort. Such development cycles are no longer tolerable, either financially or from a competitive standpoint.

Researchers at Lawrence Livermore National Laboratory are seeking to transform government product development by coupling additive manufacturing technologies, predictive modeling and simulation, and real-time fabrication process measurements to significantly reduce the time required to certify components with high certainty.

Photo Credit: www.3ders.org

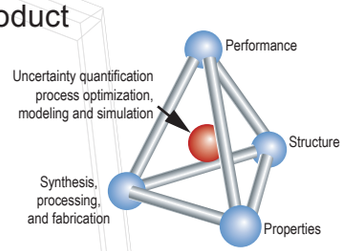
Two areas historically affected by long lead times for product certification are aerospace and biomedicine. GE's turbofan engine (above) and Oxford Performance Materials' biocompatible thermoplastic "bone" (below) both were produced using additive manufacturing technologies.

Photo Credit: Oxford Performance Materials

LLNL is conducting research on ways to improve the certification process:

- Modeling and simulation to predict product performance
- Techniques for in-situ characterization, so the manufacturing process itself is "certified" for each individual product

By coupling the elements in the bullets above, the research direction can ultimately lead to rapid certification of additivelymanufactured products and materials.



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