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How far we can go to print a jet engine? The beauty of a 3D printed micro jet engine

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Additive manufacturing (AM) opens a new era, including aircraft engine design and manufacturing. In addition to being capable of solving problems with complex shapes that are difficult to make with traditional methods, the revolutionary power of AM is due to the feature of making objects from micro to macro scale, similar to natural processes such as how living beings grow from small to large. Now one can put different materials together where needed, either mixed or embedded. One can proactively design micro structure under the surface of a structure to arrange distribution of mass, stiffness, damping, failure mode and its location, thermal property, etc., according to the functional requirement of the part. This is what we call Additive Design (AD), not design for AM. AD will be a new area of engineering that will change people's vision of design and lead to exploring the further capabilities of existing materials by optimizing the load distribution, such as reducing stress concentration substantially. We made a micro jet engine in 3 months using AD technology developed by a small group with young people of less than 10 members. From inlet to the tail nozzle, all parts are made of metal using SLM by outsourcing to different companies. The entire engine consists of no more than 15 parts. All parts have some features that are either difficult or impossible to be made by traditional methods. These features are characterized by light weight, structural integrity, and cost savings.



Figure 1: Jet engine made from AD and AM

Biography

Pinlian Han graduated with BSc and MSc from Xian Jiaotong University in China, another two MSc degrees in USA and one PhD degree in Canada. He has worked at Pratt & Whitney Aero Engine Company in USA for more than 12 years as Technical Leader in 7 different Departments. He has published over 70 papers and more than 50 patents. He is currently the Chair Professor in the Department of Mechanics and Aerospace Engineering, leading a team to break through the bolt neck of aero engine with innovative technology and methodology, focusing on additive design and developing a new type of aero engine called Amphibious Relay Gas Turbine.

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