CERAMIC COMPONENTS

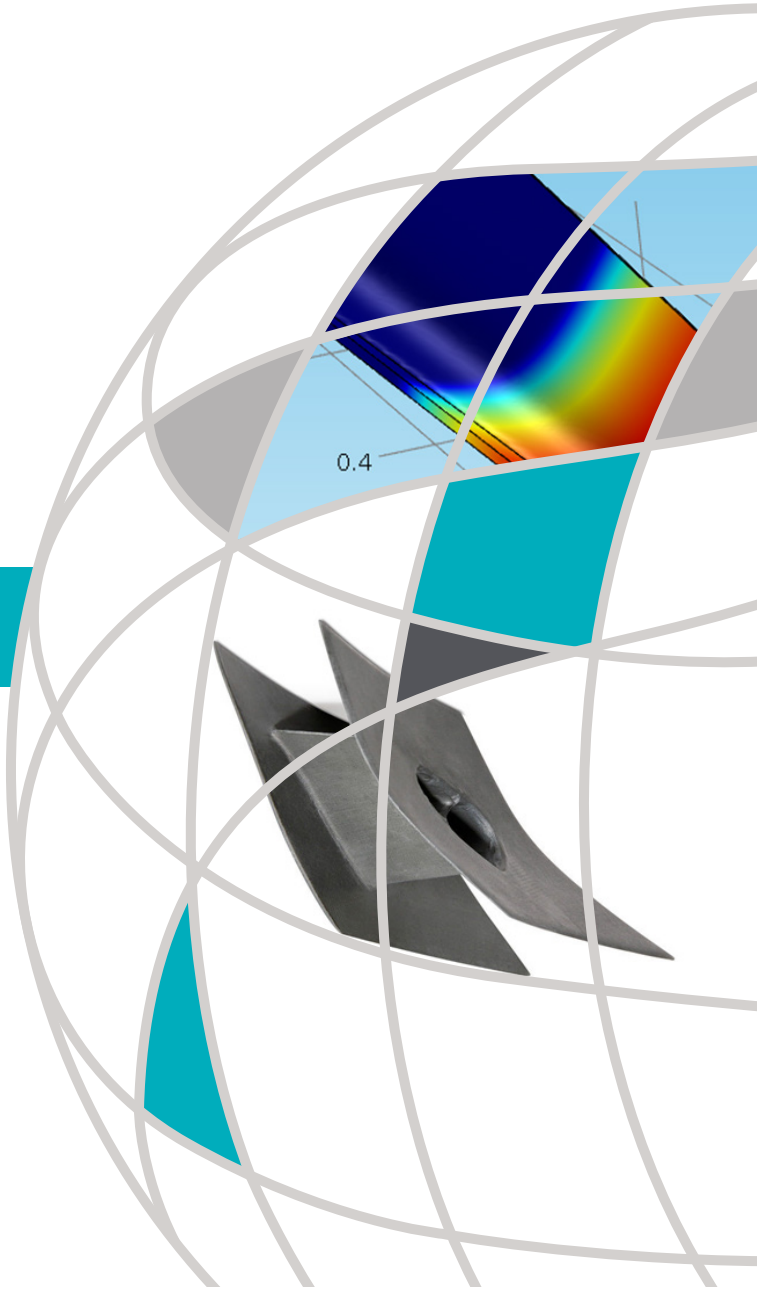
ALTASIM ADAPTS TOOL FOR DESIGNING CERAMIC PARTS TO MANUFACTURING APP

AltaSim Technologies partnered with AweSim to develop an online manufacturing app version of the company's modeling and simulation tool for developing ceramic-matrix composites (CMC) in aero-engine applications. Traditionally, the aviation industry manufactures internal engine parts using metals and alloys, which often come within 50 degrees of their melting point during engine operation. Next-generation engines will replace these materials with CMCs, which can withstand operating temperatures approaching 2000 degrees Fahrenheit. CMC components will improve thrust and fuel efficiency while reducing emissions, simplify component design and reduce the supporting structure weight.

However, ceramics are subject to fracture, a factor that has limited their use in high-stress structural elements such as turbines. To mitigate the highly complex manufacturing process, AltaSim turned to predictive computational design tools that use HPC-based hardware. AltaSim engineers, in collaboration with AweSim are developing an online manufacturing app version of the tool to make it more accessible for engineers to use on a routine basis.

"Barriers can be significantly reduced by using predictive computational design tools. The range of physical phenomena that must be incorporated is large and the interactions that occur between them is complex; consequently, no routine commercial simulation tool is currently available."

— *Jeffrey Crompton, Principal, AltaSim Technologies*



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REALIZING TOMORROW'S TECHNOLOGY

2014

THE CHALLENGE

Traditionally, aviation industry manufacturers have relied on metals and alloys such as nickel, titanium and steel to produce internal engine parts. These conventional materials often come within 50 degrees Fahrenheit of their melting point during engine operation, making them inefficient at best. Next-generation engines are being designed with ceramic components, which can withstand operating temperatures approaching 2000 degrees Fahrenheit. Components made of ceramics improve thrust and fuel efficiency while reducing emissions, simplify component design and reduce the supporting structure weight. However, ceramics are subject to fracture, a factor that has limited their use as high-stress structural elements in turbines.

THE APPROACH

To address this challenge, there has been a research movement to develop a mixture of ceramic matrix and ceramic fibers that will maintain operation at high temperatures while also providing structural durability. Because the manufacturing process for ceramic-matrix composites is so complex, it stymied the production of these components. By using predictive computational design tools, AltaSim could leverage modeling and simulation to break down manufacturing barriers.

THE SOLUTION

Since no routine design tool was available, AltaSim created their own predictive computational modeling and simulation tool specifically for the CMC manufacturing process. However, it required advanced computer software and HPC-based hardware. To make it more accessible, AltaSim partnered with AweSim to develop an online manufacturing app version of the tool. Not only does this meet the demands of engineers in the aviation industry, but the app opens the door for small- and medium-sized businesses who may also be interested in using CMCs. The app makes CMC product design accessible for non-expert users, furthering the development of intelligent interfaces around a common framework.