CAM Software Helps Xcelaero Cut Design & Manufacturing Times

Xcelaero Corporation of San Luis Obispo, CA, specializes in in custom vane axial and radial fans for the commercial and defense industries using state-of-the-art techniques and technologies adapted from the aviation gas turbine industry to achieve the highest possible fan efficiencies. Typically, Xcel-aero's axial fan designs utilize complex shrouded vane sets, which present unique manufacturing challenges due to a lack of tool access and minimal spacing between vanes. Xcelaero is successful in part because they purchased 5-axis computer-aided machining (CAM) software from Concepts NREC, the company said.

Finshed fan with freeform blades. This component did not require an itegrated shroud.

"To prototype our fans we purchased a 5-axis vertical machining center and coupled it with Concepts NREC's 5-axis CAM software family including the MAX-PAC™ and MAX-SI™ package specifically for shrouded vane sets," said Bill Denzel, Engineering Manager of Xcelaero. "Additionally, we chose to use the Concepts NREC CAM family because it merged seamlessly with our impeller design software."

Denzel added that three-dimensional (3D) modeling is not required to generate vane tool paths. Therefore, Xcelaero's shrouded vane designs transfer directly from its aerodynamic design software to the CAM software without generating an intermediate 3D model. This seamless transition ensures that the vane design cannot be corrupted by the 3D modeling or import/export processes. However, MAX-PAC is also capable of importing 3D CAD models.

The Challenge

Before purchasing the Concepts NREC CAM suite, Xcelaero used another popular commercial CAM program to create 3+2 and 5-axis tool paths to machine impellers and shrouded vane sets. This solution, however, was very labor intensive requiring several iterations to find the optimum tool approach angle and confinement window. Additionally, the CAM software produced a patchwork of surfaces that were difficult to blend together because the tool paths were created from an exported 3D solid model that included separate individual surfaces around the blades and vanes.

The challenge was to find CAM software that improved the efficiency of tool path generation, which also integrated with Xcelaero's existing fan design software and created continuous 5-axis blade and vane surfaces.

Solution

"The Concepts NREC software family was recommended to us by a consultant who specialized in programming 5-axis tool paths," said Denzel. "The consultant had utilized several other CAM packages and recommended Concepts NREC as the predominant CAM programming supplier for serious fan manufacturers."

Xcelaero's Machine Shop Manager spent three days training onsite with a Concepts NREC Application Engineer. The first two days were spent introducing the basics of the Concepts NREC software family and the third was spent creating code specifically for Xcelaero's fan designs.

Concepts NREC software runs on Windows 2000, XP, NT or Vista and does not require advanced processor or graphics hardware. Xcelaero's computers were more than adequate, so the company did not have to purchase any additional equipment.

MAX-PAC uses a patented collision detection and avoidance algorithm that allows the use of larger, stronger cutting tools than other CAM systems. Socalled "lollipop" tools, with a cutting ball on the smaller shank, can even be used to reach areas that are not visible to the eye.

The CAM software automatically calculated the optimum approach angle given the blade, tool and tool holder geometry, which significantly reduced the amount of time required to generate tool paths. The resulting 5-axis tool paths produced seamless vane surfaces particularly at the leading and trailing edges and vane root fillets.

"Concepts NREC's software included several tool path routines written specifically for blades. We prefer to use the flow line option that generates tool paths to follow flow lines around the blades," said Denzel. "The flow line tool paths allow us to use a larger step over between tool passes and reduce the overall manufacturing time while not sacrificing surface roughness in the direction of the flow."

Return on Investment

By implementing the Concepts NREC MAX-PAC CAM software family, Xcelaero reduced the time required to create 5-axis programs for shrouded vane sets from one week to two days. Additionally, the tool paths generated reduced manufacturing time by 40 percent by eliminating the need to flip the shrouded vane set over. And, Xcelaero virtually eliminated the production of scrap parts during the initial prototyping process.

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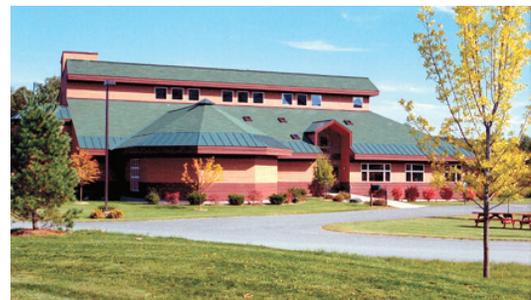
CORPORATE HEADQUARTERS
217 Billings Farm Road
White River Junction, VT 05001-9486 USA
Phone (802) 296-2321 • Fax (802) 296-2325
E-mail: sales@ConceptsNREC.com
Web: www.ConceptsNREC.com