Concepts NREC

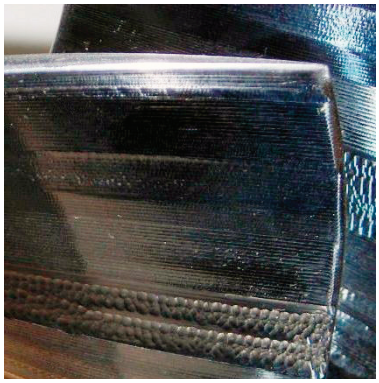
The Experts in Turbomachinery

Case Study

Teleflex Aerospace Replaces General CAM System for Better Geometric Accuracy

MAX-AB™ roughing and finishing strategies eliminate hand finishing of aircraft engine blisks

Teleflex Aerospace Manufacturing Group (formerly Sermatech Manufacturing Group) of Cincinnati, Ohio, provides a diverse range of manufacturing and engineering services for producing both prototypes and production quantities of aerospace components. To manufacture blisk components, Teleflex uses a combination of electrochemical machining (ECM) and five-axis milling. Their typical approach is to form the blades with ECM and then mill the hub surface.



Toolpaths generated with general CAM software resulted in rough surfaces that required hand finishing.

In 1998 when Teleflex first purchased Concepts NREC's five-axis machining module MAX-AB, their primary intent was to use the software in their blisk manufacturing process. MAX-AB is one of Concepts NREC's sophisticated MAX-PAC™ CAM software tools and provides a specialized solution for creating five-axis toolpaths for impellers and blisks. MAX-AB's hub-milling strategy provides an optimal flow line milling pattern to blend with the high quality ECM surfaces. After nearly eight years of experience using MAX-AB, Arlon Stringer, Plant Manager at Teleflex, is still enthusiastic about the program's toolpath accuracy and the consistent quality he's been achieving. According to Stringer, "We've been getting great results for years, but only now that we're milling some blisks from solids are we utilizing MAX-AB's complete set of roughing and finishing strategies." Teleflex recently took over production of a blisk for a General Electric commercial aircraft engine. The blisk had been produced by one of Teleflex's sister divisions where the toolpaths had been generated with a general CAM system, and the resulting surface quality was rough enough that significant hand finishing was required.

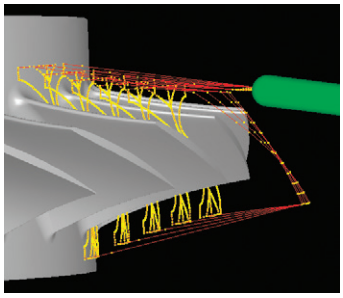
The toolpath accuracy of MAX-AB greatly improved surface finish and eliminated most post-machining finishing.

After moving the entire operation to Cincinnati, including milling machines, it was decided that some

Teleflex Aerospace Replaces General CAM System for Better Geometric Accuracy, continued

process improvements were needed to reduce or eliminate postmachining finishing and improve surface accuracy and surface finish. Teleflex discussed the problem with engineers at GE Aircraft (who also use MAX-AB) and decided that MAX-AB could provide a much better result than the previously used general CAM system.

Teleflex soon had new roughing and finishing toolpaths running on the machine, with a significant improvement in surface quality. Hand finishing was no longer required, better geometric accuracy was achieved, and production costs were significantly reduced.

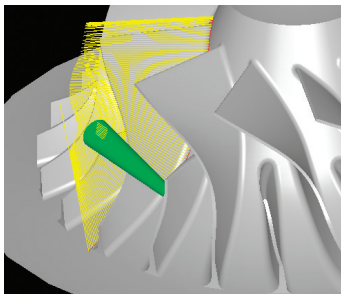


MAX-AB point milling

MAX-AB uses a patented method for avoiding collisions between the cutter/holder and the blades. The method produces smooth five-axis toolpaths with reduced machine motion and acceleration that result in a superior surface finish and shorter milling times. General application CAM systems and even some specialized CAM tools have limited options for choosing tool vectors and avoiding collisions.

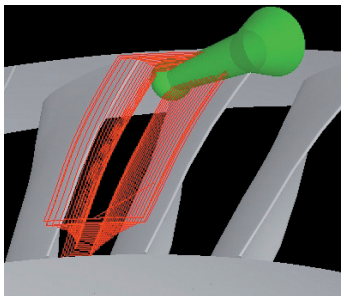
According to Stringer, “MAX-AB delivered the part quality that GE expected, and we eliminated costly secondary operations that might compromise part fidelity. Everyone is pleased.” Worldwide users of MAX-AB and other MAX-PAC modules are achieving similar high-quality results.

MAX-PAC machining modules



MAX-5 flank milling

Manufacturing turbomachinery components is often challenging. Designs may specify hard materials, have thin blade sections, require slender cutters, or have tight tolerances and smooth surface-finish requirements. Concepts NREC offers three specialized MAX-PAC machining modules designed to quickly generate tool-paths for a variety of turbomachinery components.



MAX-SI for integrally shrouded components

MAX-AB is used to create five-axis NC machining instructions for point milling of arbitrary or ruled-surface turbomachinery components, including axial compressors and turbines, radial compressors, pumps, turbochargers, radial-inflow turbines, and inducers. Typical programming time is measured in hours, not days or weeks as required by general purpose CAD/CAM software.

MAX-5™ creates five-axis NC machining instructions for flank milling of ruled-surface turbomachinery components. Typical applications include centrifugal compressors, pumps, inducers, turbochargers, stators, fans, radial-inflow turbines, expanders, and torque converters. Dramatic cost savings can be realized using ruled-surface designs and production because the flank milling process allows the entire blade surface to be finished with one pass.

MAX-SI™ generates five-axis NC instructions for milling integrally shrouded turbomachinery components such as expanders, pumps, process compressors, turbines, and turbine nozzles. MAX-SI also generates machining instructions for large axial compressors and blisks using a side-entry machining approach.

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