

Reduce Costly Design Changes and Physical Tests

# Tusas Engine Industries, Inc. (TEI)



Gas Turbine Engine

Turkey

[www.tei.com.tr](http://www.tei.com.tr)

# ANSYS®

## ANSYS® Mechanical™

### Overview

Tusas Engine Industries, Inc. (TEI) is a leader in developing and producing a range of high-quality aircraft engine parts for the worldwide aerospace industry.

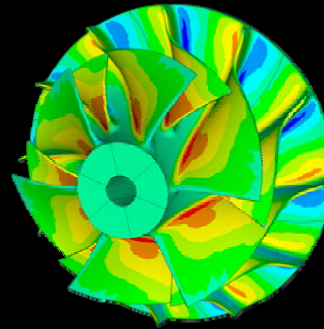
In developing the Tusas TEI-TJ-1X microjet engine used in unmanned air vehicle (UAV) applications such as target drones, the company needed to design a radial compressor impeller that was compact, lightweight and capable of reaching rotational speeds in the order of 100,000 rpm. Achieving such performance levels presented particular design challenges for Tusas engineers.

### Testimonial

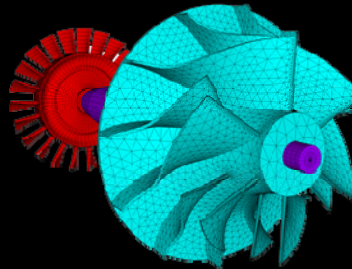
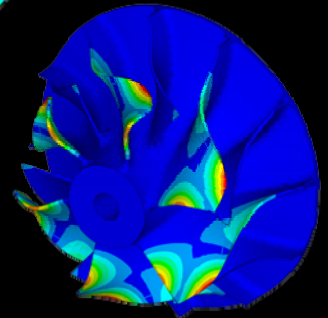
“Simulation in the early stages of the development cycle provided valuable insight for quickly identifying potential problems and evaluating alternative solutions. This prevented large numbers of costly and time-consuming late-stage design changes and enabled us to verify the design with the minimum number of physical tests. Simulation was a critical tool in successfully developing the TEI-TJ-1X microjet engine and in the follow-on work in designing the TEI-TP-1X turboprop engine.”

**Bulent Acar**

**Design Engineering and Technologies Leader**



For the radial compressor impeller, structural analysis determines stresses and deformation (left); modal analysis shows mode shapes at various harmonic frequencies (below).



Rotordynamics analysis of the complete assembly (left) determines resonant frequencies of individual components, including the impeller, shaft and turbine.

### Challenges

- Address radial compressor impeller design challenges related to vibration, resonance, transonic flow, shock waves in diffusers and high stress levels resulting from the rotational speeds necessary to achieve high compression
- Ensure proper tip clearance under a range of operating conditions

### Solution

Use ANSYS Mechanical software to perform:

- Structural analysis to determine stresses and deformation of the impeller
- Modal analysis of the impeller to determine dynamic characteristics of the impeller
- Full rotordynamics modal analysis of the entire assembly to determine the resonant frequencies of each component
- Examination of the centrifugal and aerodynamic loads that can affect vibration of the blade and potential deformation of its geometry

### Benefits

By using ANSYS Mechanical:

- Stresses in the critical regions of the impeller were reduced by 20 percent.
- Engineers gained valuable insight to quickly identify potential problems, evaluate alternative solutions and reach acceptable performance levels.
- Costly and time-consuming late change orders were avoided.
- Verification of the design with the minimum number of physical tests was possible.