

Case Study



ANSYS® + **DUXION**

“DuXion prides itself in producing accurate models while iterating quickly, and there is no better way to achieve this than by using the industry-leading simulation software from ANSYS. Utilizing ANSYS TurboSystem and the ANSYS Fluent suite, DuXion was able to iterate more quickly and get solutions that would have taken much longer otherwise. Incorporating ANSYS into our design process has enabled us to create the new technology and believe in our solution.”

Sheikh Rabbi, Ph.D.
Co-Founder & VP Electrical Systems
DuXion Motors, Inc.

Simulating the Future of Electric Aircraft Propulsion with ANSYS

In the aerospace market, there is a major push to move toward electric flight to realize a cleaner future, reduce operating expenses and produce more reliable machines. Annually, billions of dollars are spent by major airlines on fuel consumption strategies, and there is constant pressure from governments and society to find a better solution. As such, DuXion has set out to develop a highly efficient, light and compact electric propulsion unit for several aerospace applications that range from passenger aircraft to UAVs. However, to be competitive in this market, companies need to move fast and prove their ability to comply with a robust set of rules and regulations.

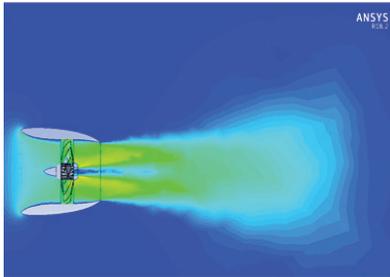


Figure 1: Sliding mesh method in ANSYS Fluent – velocity contour plot.

Challenges

Due to the level of system complexity, approximations and rapid prototyping are not feasible options for creating initial design models for testing. Creating a design and being able to simulate it in an environment where every result is meaningful is essential to developing efficient and reliable machines. ANSYS software was

the logical, cost-effective choice to execute design analyses and optimizations, while saving hundreds of hours of analysis time.

Technology Used

DuXion's core aeromechanics focus is on pushing the operational limits of turbomachinery. To optimize our designs and develop novel solutions in the electric propulsion space, we use a wide array of tools:

- ANSYS® BladeModeler™
- ANSYS® TurboGrid™
- ANSYS® Meshing
- ANSYS® Mechanical™
- ANSYS® CFX®
- ANSYS® Fluent®

Engineering Solution

ANSYS delivered a comprehensive set of tools for simulating the complex operation of an electric propulsion system and modeling the electrical, mechanical and thermal properties. Some of the core applications used in the ANSYS suite include:

- Dynamics™ ANSYS® RMXprt™ for quickly designing and optimizing preliminary electric motor models.
- ANSYS® Maxwell® and ANSYS® Simplorer® to perform electromagnetic performance analysis of design models.
- ANSYS® Vista TFTM and BladeModeler to generate preliminary 3D blade models.

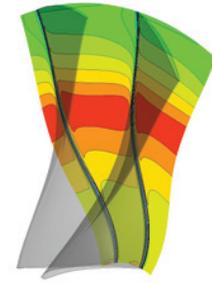


Figure 2: Multi-blade passage using ANSYS CFX turbo mode – velocity contour plot.

- TurboGrid for automatically generating high-fidelity mesh tailored to turbomachinery.
- Mechanical APDL to conduct finite element simulations of the fan blades.
- CFX and Fluent solvers to simulate the fluid flow through the fan blades/propulsion unit and determine maximum achievable thrust.

Benefits

DuXion sought to develop an optimized design for its electric propulsion units using accurate and reliable engineering simulations, thus avoiding the massive cost and delay associated with real-world prototyping and model testing. ANSYS engineering simulation software helped DuXion meet its goals in the following ways:

ANSYS engineering simulation software helped DuXion meet its goals in the following ways:

- Quick design iterations in a fast-changing workplace, saving hundreds of hours of work and increasing the value of the intellectual property developed.
- Lower operational costs to finalize a design before going into the prototype phase — a necessity for a startup.
- Multi-goal optimizations, including unit weight reduction while maximizing thrust and efficiency.

Company Description

DuXion, Inc. is a Canadian startup founded by a team of electrical, mechanical and aerospace engineers that is building the future of electric propulsion systems for aircraft and other transportation applications. The company is designing an electric motor-driven, ducted fan propulsion system that reduces weight as well as footprint, and generates more thrust by directly integrating the ducted fan into the rotor. With a patent pending, the team is focused on optimizing the design in preparation for a build of a full-scale unit in the upcoming years.

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