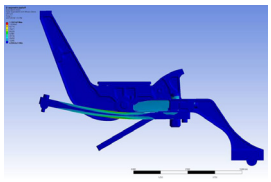
Case Study

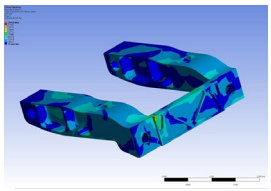
"ANSYS Mechanical tools have greatly improved the accuracy of our finite element analysis (FEA) simulations and the efficiency of our computer-aided engineering workflow, enabling us to improve our product's performance. In the past, we spent a lot of time working around the limitations of our FEA tools, but working with ANSYS simulation software is empowering — we're always impressed with its breadth of features, robustness and ease of use."

Josh Caputo
President & CEO
HuMoTech,
Pittsburgh, PA, USA

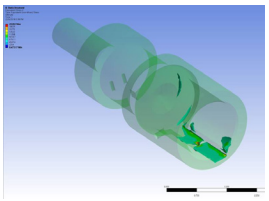
HuMoTech Enables Real-Time Testing and Assessment of Prosthetic Designs



Assembly simulation of the prosthetic foot under maximum user weight applied asymmetrically to one side of the foot. Designing for a factor of safety (FOS) of two at maximum expected cycles.



Assembly simulation of the prosthetic forefoot sides and crossbeam under maximum user loading against the dorsiflexion hard stop loading configuration.



Part simulation of the rope pulley on the actuator unit, designed for infinite fatigue life.

Designing and prescribing lower-limb prostheses is hindered by uncertainty in both research and clinical settings. Researchers struggle with the high cost and time requirements of prototyping, with no way to pre-test specific parameters. Prosthetists and patients cannot efficiently "test drive" prosthetic devices, which may be resulting in higher costs and less than ideal quality of life. HuMoTech's emulation solution tackles all these challenges.

Challenges

In the development of a robotic prosthesis, mechanical FEA is not optional — it is imperative. In our design work, we often face open-ended requirements, such as maximizing or minimizing a part's stiffness or weight. Users' hopes and dreams for prosthetics are constantly pushing the boundaries of what is possible. Simulation is the only method that cuts through the high cost of trial-and-error learning.

Technology Used

ANSYS Mechanical

Engineering Solution

HuMoTech's engineers used the following features of ANSYS Mechanical to overcome their challenges:

- Full assembly simulations considering preloads to allow for more realistic results.
- Mesh control and refinement to speed up simulation time.
- Contact definitions to improve realistic stresses between parts. This has been especially useful for parts with large elastic deformations.
- Fatigue analysis to improve estimates of the lifetime of system components and inform users when parts should be serviced.

HuMoTech's prosthetic foot worn by a user with unilateral transtibial amputation.

Benefits

- 25 percent weight reduction of the prosthesis end-effector, which allows our device to more accurately emulate a wider range of prosthetic devices.
- Increased productivity when setting up and running simulations, allowing us to do more thorough analyses.
- Higher confidence that parts will be robust in the harshest conditions over years of use.

Company Description

HuMoTech makes high-performance tethered robotic prosthesis and exoskeleton emulator systems. These systems provide users with the physical sensation of wearing candidate devices without requiring the manufacture and fitting of each physical product. This enables rapid evaluation of design concepts for R&D. It also opens the way for cost-effective, evidence-based prescriptions which enable patients to easily test different devices.

Emulators are used in a variety of cutting-edge research studies at universities and government labs around the U.S. HuMoTech is currently developing clinical applications of the prosthetic foot emulator in partnership with a team of VA and DoD researchers.

ANSYS, Inc.
www.ansys.com
ansysinfo@ansys.com
866.267.9724