

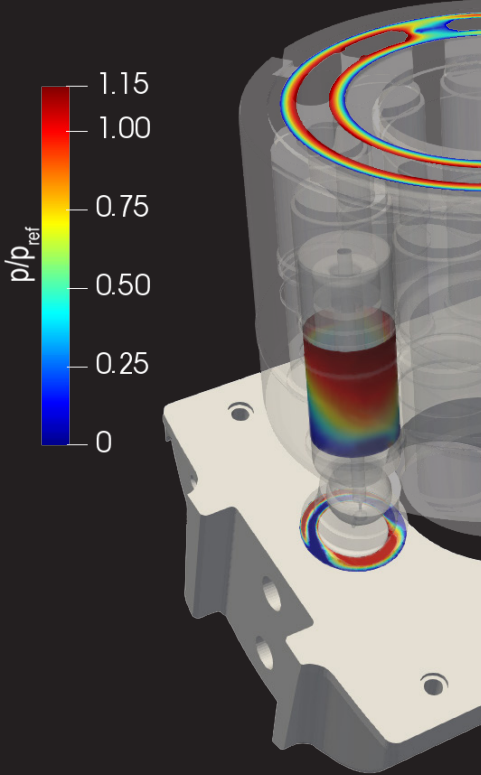
Maha Fluid Power Research center

Multics

- A Multi-Physics Simulator

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Multics is a cross-platform, multi-physics **modeling software for positive displacement machines**. It enables **rapid design assessment**, and **optimization**. Multics simulates the operation of hydraulic pumps/motors considering the micromotions of the internal parts, their deformation, and the power losses in the lubricating films. It also accounts for fluid aeration and cavitation. The software is **highly configurable** for different types of pumps and motors. The current presets include **axial piston machines** (Multics CASPAR), **external/internal gear machines**, and **gerotors** (Multics HYGESim).



Multics CASPAR - Axial Piston Machines

This preset models swashplate type axial piston pumps and motors. It allows assessing the machine performance by calculating:

- Energy Efficiency
- Flow/Pressure Ripples
- Swashplate control effort

Multics CASPAR also provides powerful insights on lubricating film characteristics, such as:

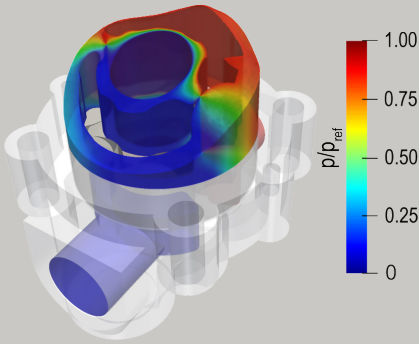
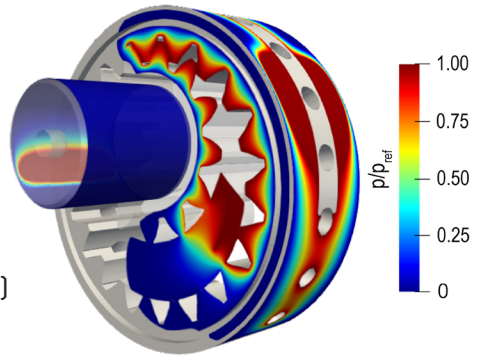
- Film thickness and contact
- Body motion and deformation
- Pressure distribution
- Heat dissipation

*All with experimentally validated accuracy.

Multics - Internal Gear Machines

This module evaluates unit performance with the following features:

- Flexible gear geometries
- Axial and radial filling of volumes
- Pinion/ring gear journal bearings
- Lateral balancing (Pressure Plates)
- Radial balancing (Split crescents)



Multics - Gerotor Machines

Simulations are performed considering:

- Standard (epitrochoidal, hypotrochoidal, cycloidal) and unconventional (elliptical, asymmetric, cosine) profiles
- Contacts considering profile tolerances
- All sources of torque and leakage loss

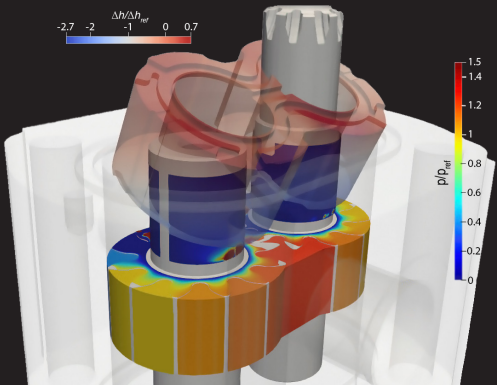
Multics - External Gear Machines

Insights on the unit operation, hydromechanical and volumetric efficiency can be calculated for:

- Helical and spur gears
- Involute/uncommon tooth profiles
- Axially balanced/non-balanced

Multics HYGESim allows studying the effects of:

- Wear-in of the housing
- Cavitation and aeration
- Shapes of porting grooves
- Gear meshing phenomena





Multics

User Support

- Detailed user manual
- Training tutorial



Supporting Software

Various supportive software ensure smooth input generation and output post-processing. They include:

- Influence matrix generator
- Valve plate area generator
- Gear profile generators
- Post- processing script



Test Validation

Extensive model validation of Multics has been performed at Purdue-Maha. Reference measurements:

- Pump and motor volumetric and torque efficiency
- Displacement chamber pressure
- Leakage flow and temperature
- Film pressure and thickness
- Film and body temperature
- Pressure ripple
- Cavitating conditions
- Friction analyses



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Web:

<https://engineering.purdue.edu/Maha/>
<https://altechsims.com/>

Selected References:

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