Ricardo Software
Powertrain CAE Solutions

RICARDO

Mechanical Suite 2017.1 New Features

SABR

ENGDYN

VALDYN

RINGPAK

PISDYN

Delivering Excellence Through Innovation & Technology

www.ricardo.com

Our Mechanical Suite of products include ENGDYN, VALDYN, PISDYN and RINGPAK

General Kinematic and Dynamic System Analysis

Cam Design and Valvetrain Analysis

Gear, Chain, and Belt Dynamics

Engine System Dynamics

Piston Design

Bearing Analysis

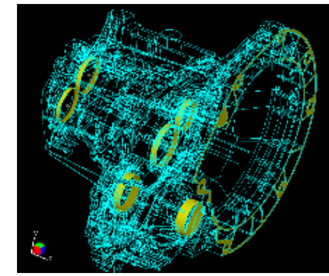
Powertrain Durability

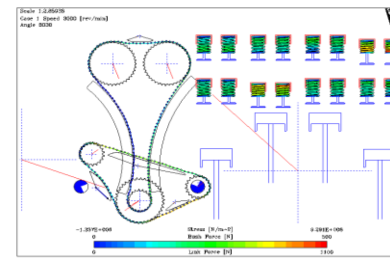
Powertrain NVH

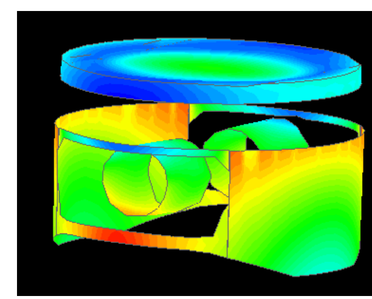
Cranktrain Analysis

Ring Pack Design

Driveline and Transmission Analysis



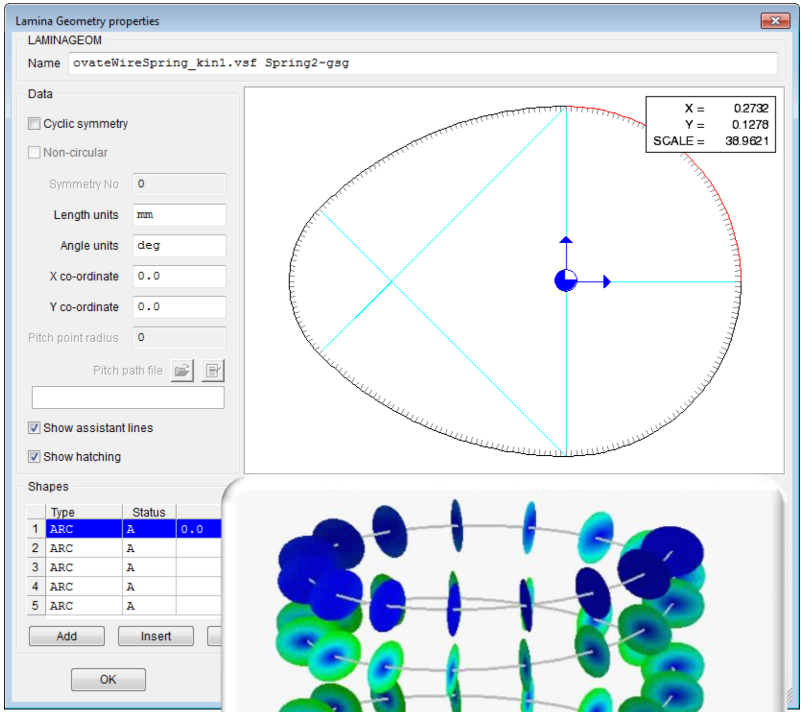


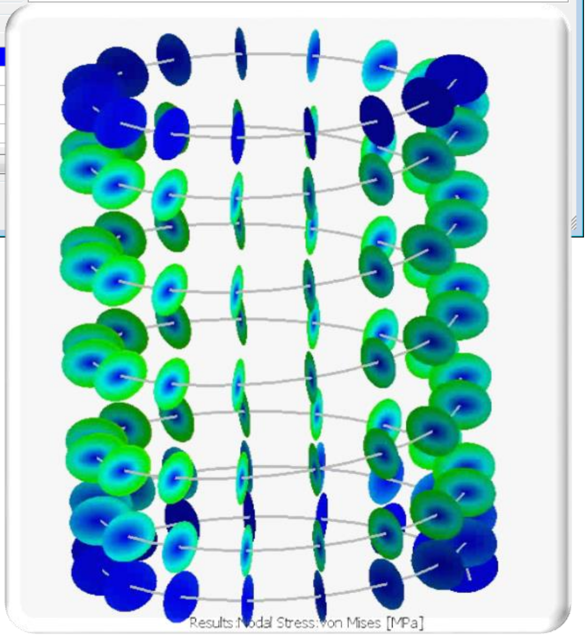


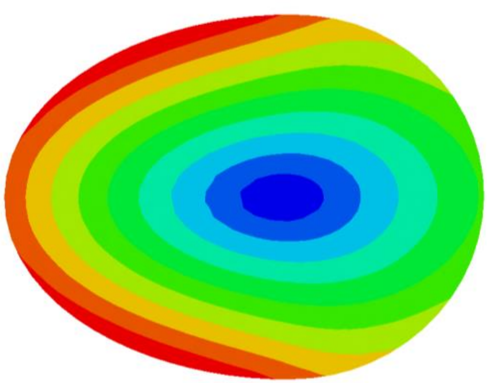
Ovate Spring

capability

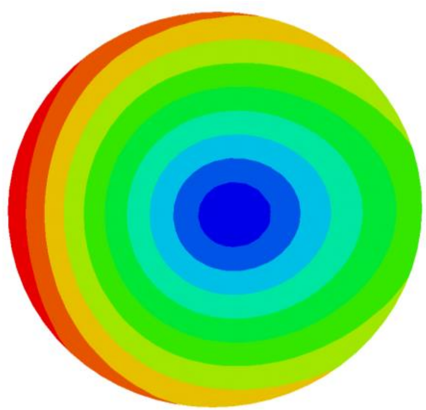
- Ovate (arbitrary section) springs in VALDYN and VALDYN Kinematics
  - 1D kinematics
    - Legacy and VALDYN-Kinematic GUI's
  - 1D and 3D dynamics
  - Embedded FE calculation using FEARCE
    - Uses St. Venant's theorem to evaluate torsional constant and stresses
  - Supports any convex spring section







Ovate Section

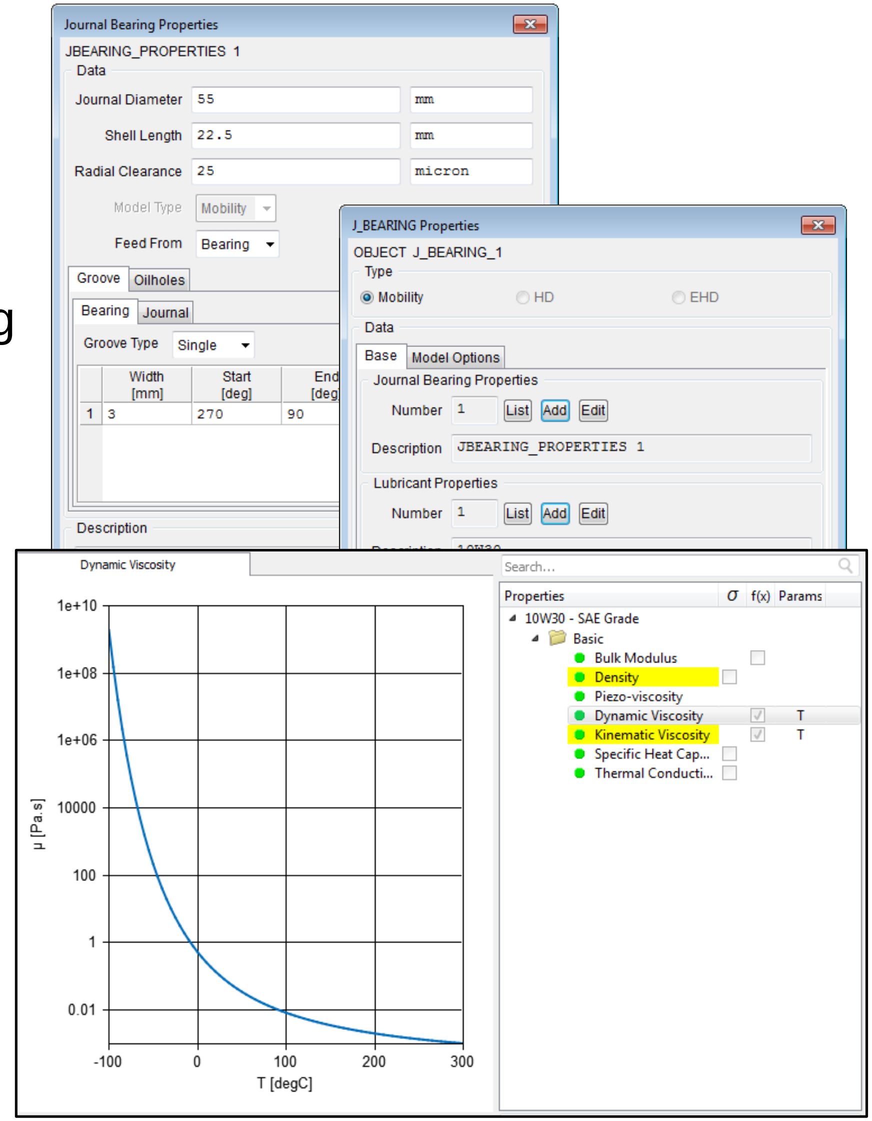


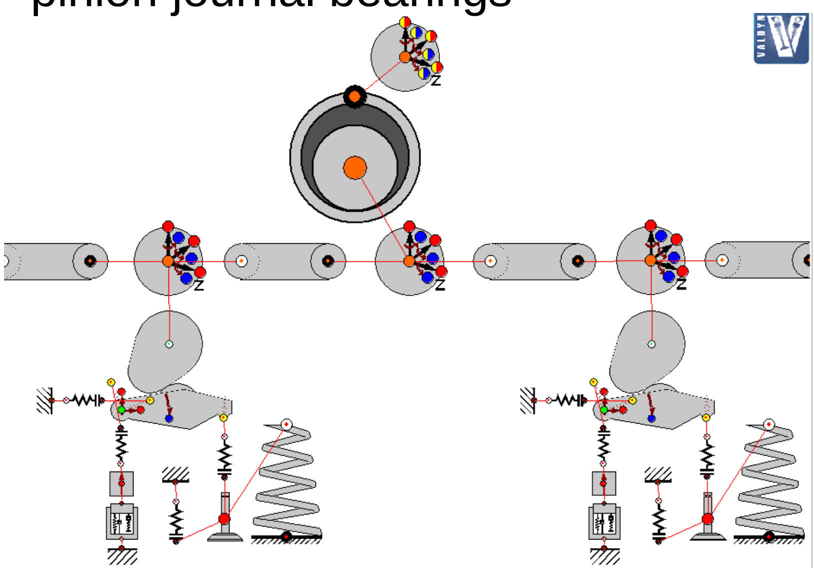
Elliptical Section

Journal Bearing

capability

- New JBEARING Journal Bearing object
  - Mobility based model from ENGDYN
    - Thermal balance option
  - EHL model to follow in 2018
  - Selection of Lubricant properties using Material Editor
  - Typical applications include modelling camshaft, balancer shaft and gear pinion journal bearings

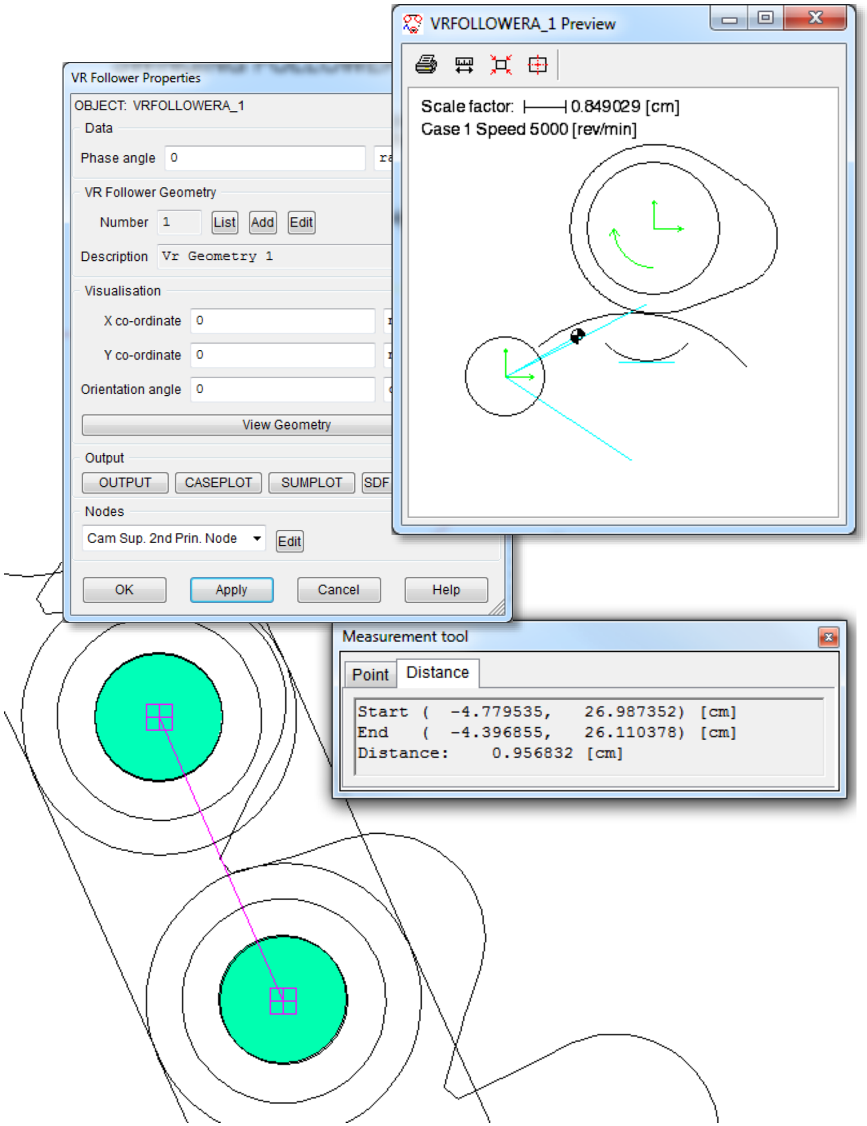




Visualization improvements

usability

- 2D visualization of objects
  - A tool that enables a rapid verification of the intended geometry
  - VRGEOM currently supported, others to follow

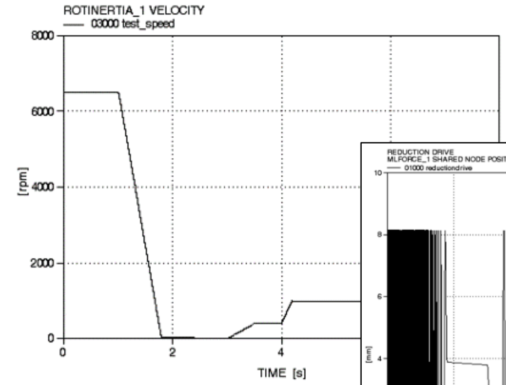


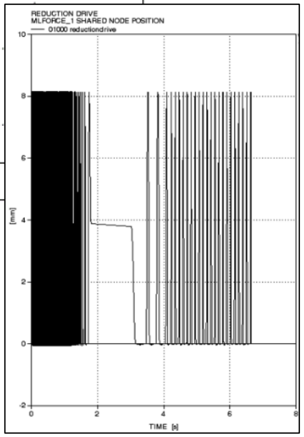
- Animator measurement tool
  - Measuring distances directly in the animator

Mechanical Suite 2017.1

flexibility and capability

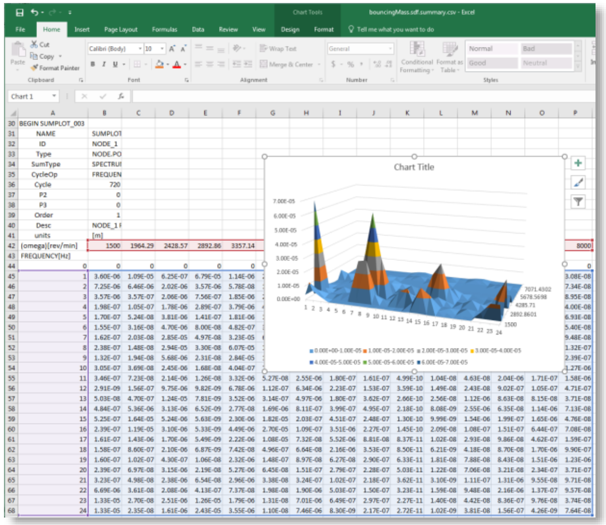
- Velocity profiles now supports contiguous zero-velocity sections
  - Enables to run a start-stop simulation or co-simulate such a simulation with WAVE





- Asperity contact area as an output from OILFILM Object

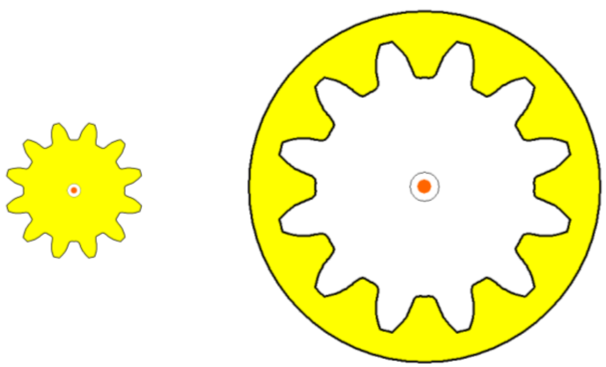
- SUMPLOT data stored directly in SDF
  - A CSV file is always exported from the SDF results file, and includes all the SUMPLOTs defined in the VALDYN model.

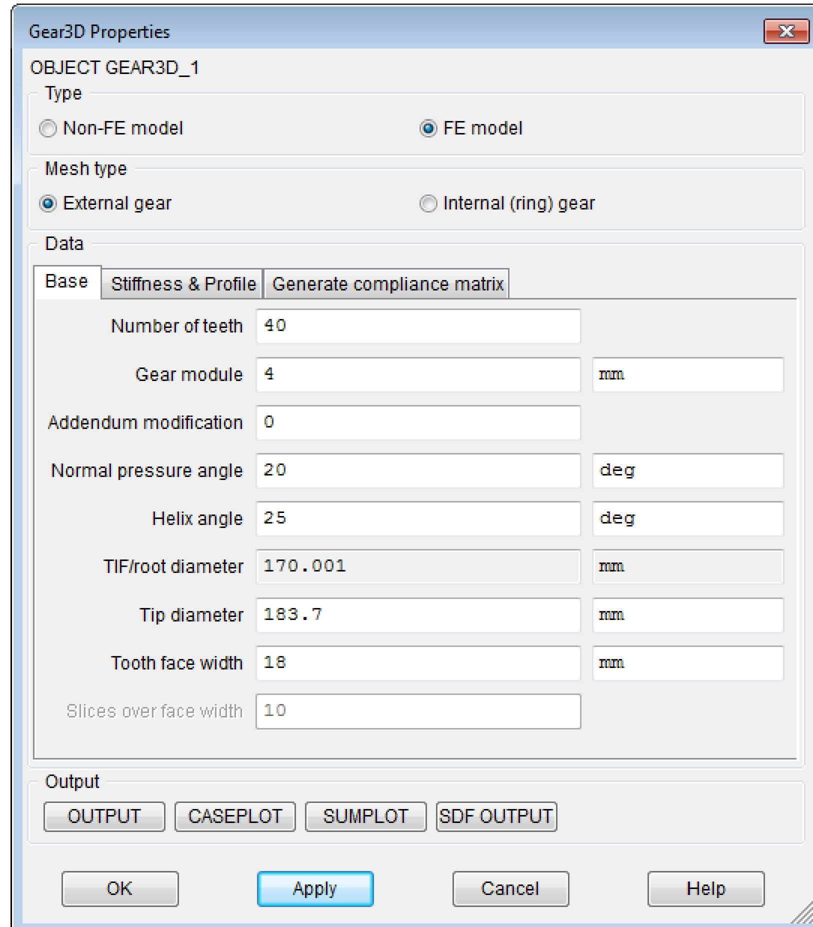


Improved GEAR3D Object

capability and usability

- Explicit Mesh Type input
  - External and Internal (Ring) types
  - Icon changes based on type

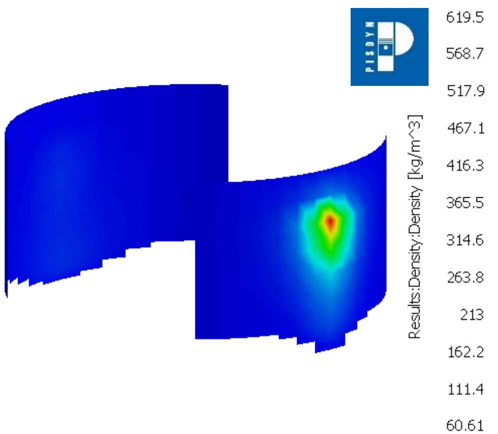


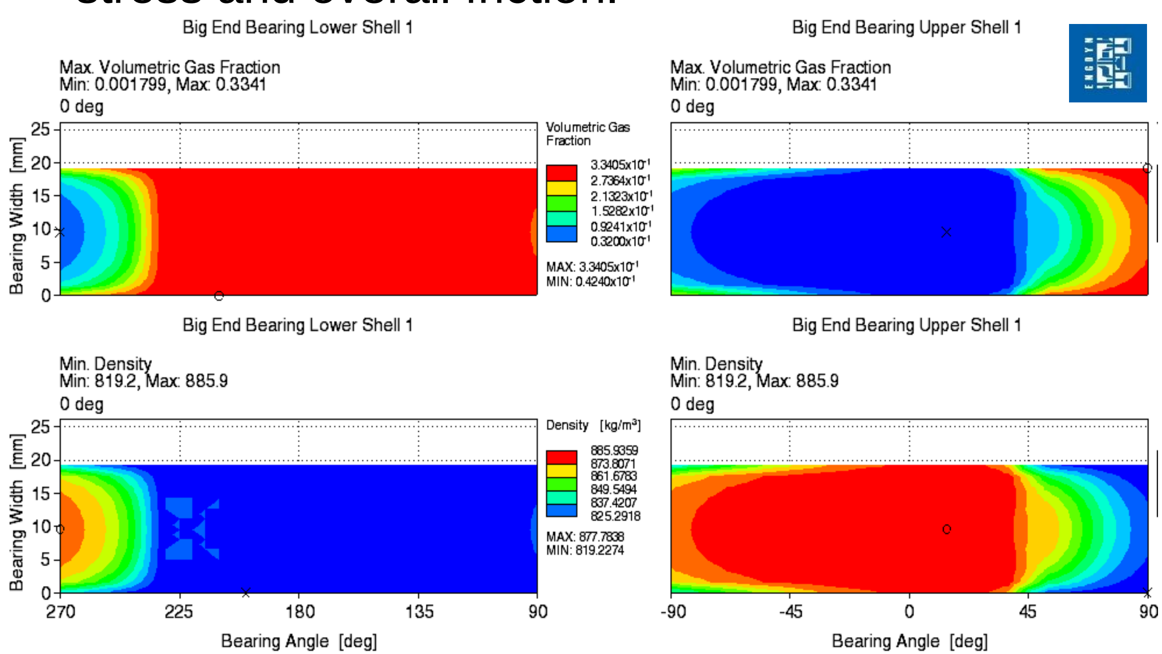


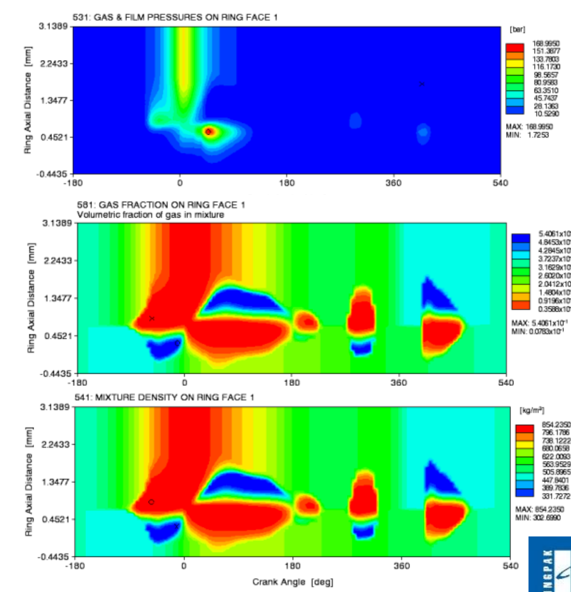
Aerated oil for lubricated surfaces

capability

- Support of aerated oil with solution of the compressible form of the Reynolds equation for all lubricated interfaces for ENGDYN, PISDYN and RINGPAK
  - Aeration of oil can have significant effects to behaviour of the lubricated surfaces. These effect can be negative by reducing of the oil film bearing capacity, but can be also quite positive by reducing of shear stress and overall friction.



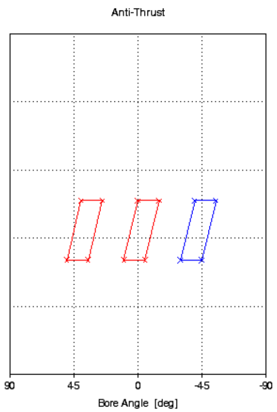


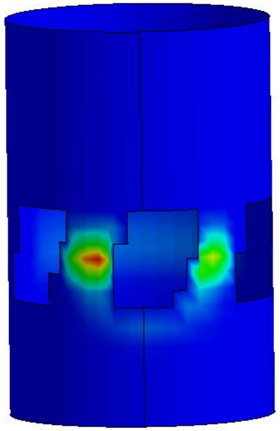


Enhanced functionality and solver improvements

capability and speed

- Support of ports on cylinder bore with the New PISDYN Solver
  - Enhanced functionality and model set-up
  - Support of non-symmetrical ports



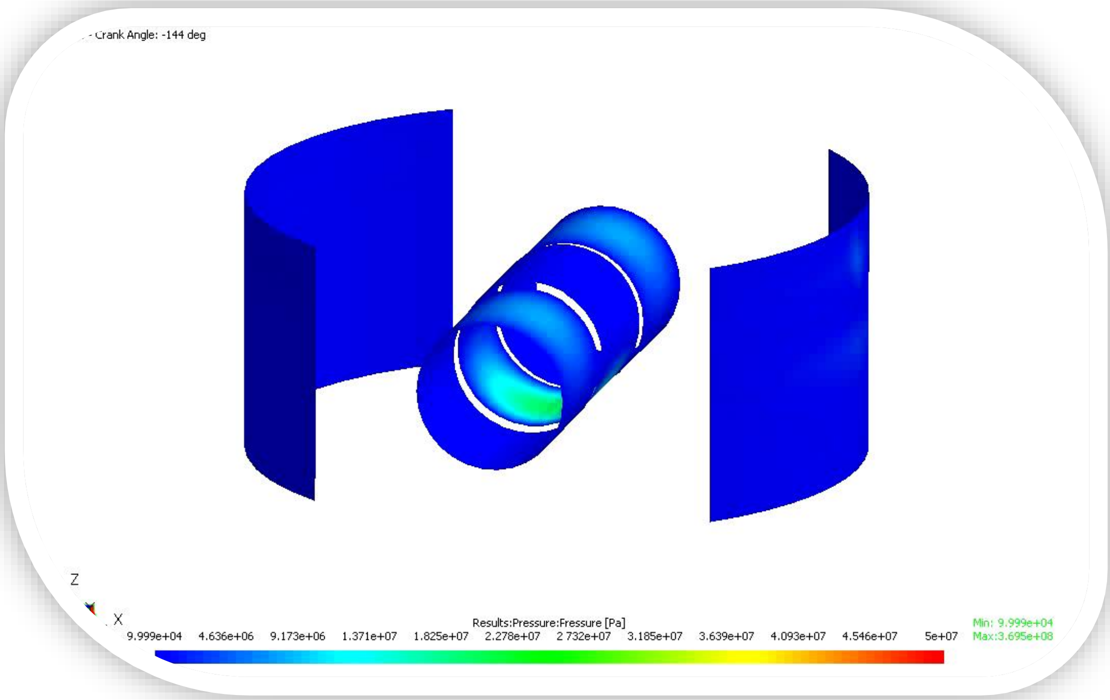


- Improved robustness of the New PISDYN Solver

Piston secondary motion animation in R-Desk

usability

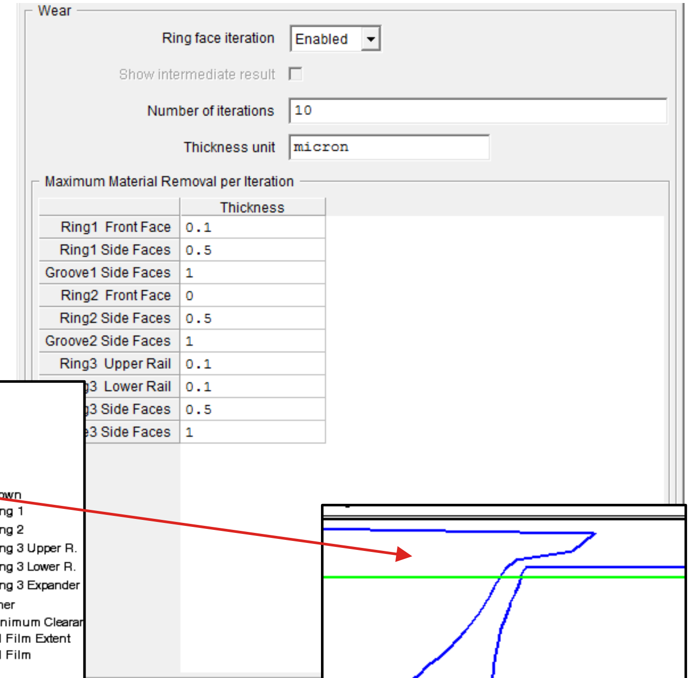
- Enables animating of piston primary motion and/or secondary motion and combining it with displacements and deformations

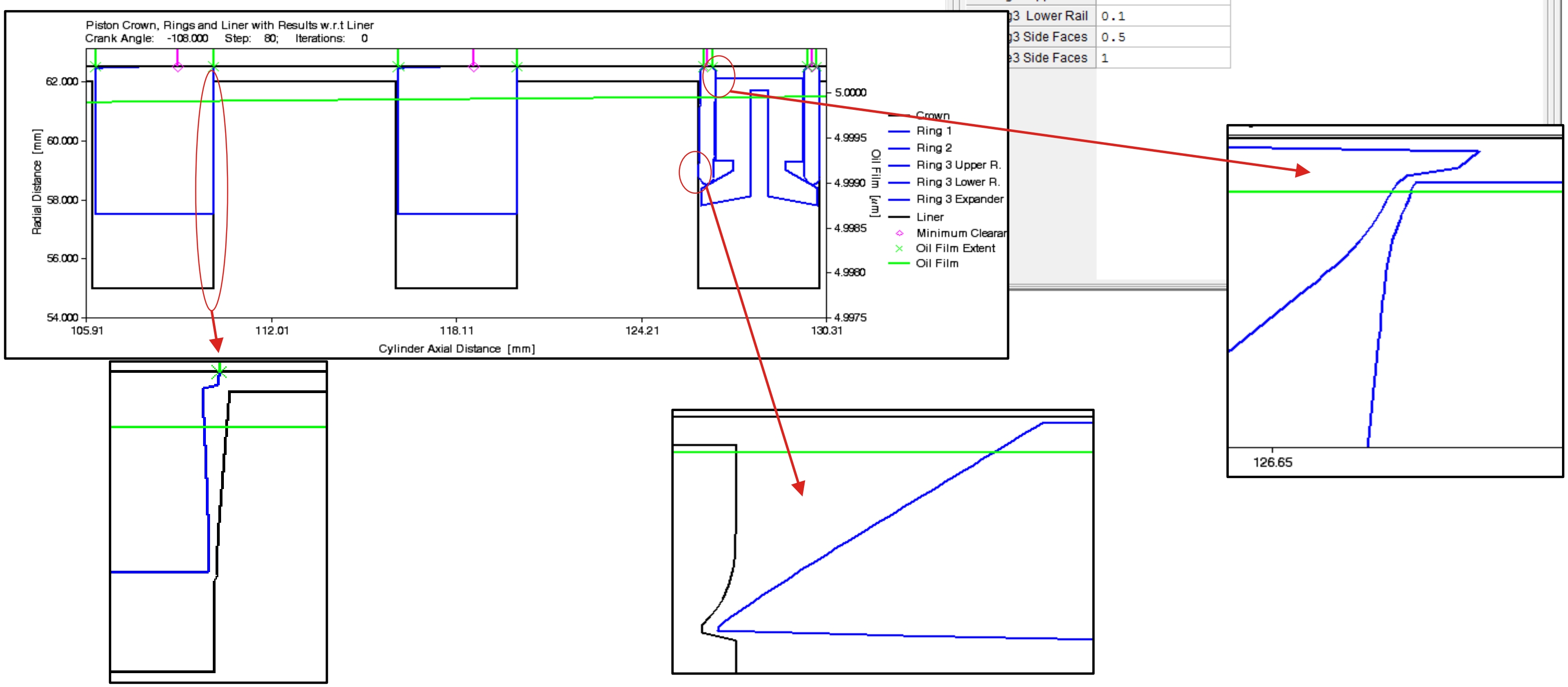


Extension of wear iteration model

capability

- Now the extension of wear iteration model to includes Ring-Groove interfaces as well as Ring-Liner interface
  - Outputs showing evolution of material removal are written to separate .rp file

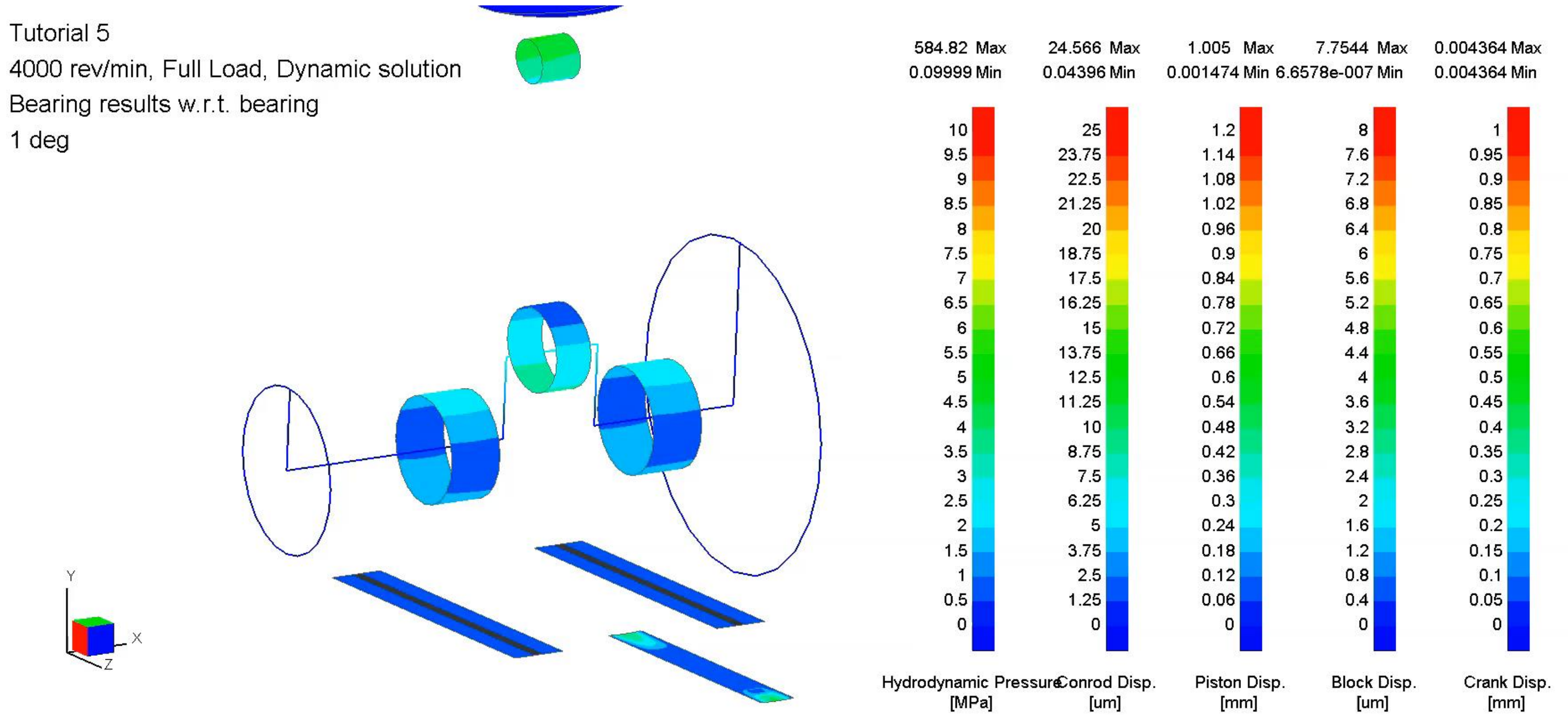




Dynamic connecting rod model now available for dynamic solution

capability

- Mobility based and EHL solutions at big end and small end bearings
- CMS Dynamic Body model of connecting rod
- Coupled solution between big end bearing and crank pin journal



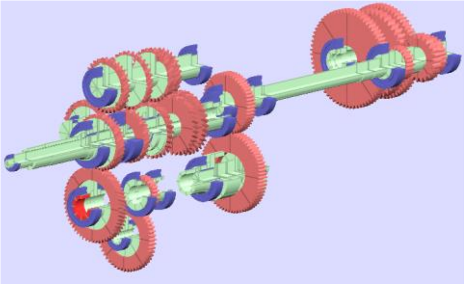
What is SABR?

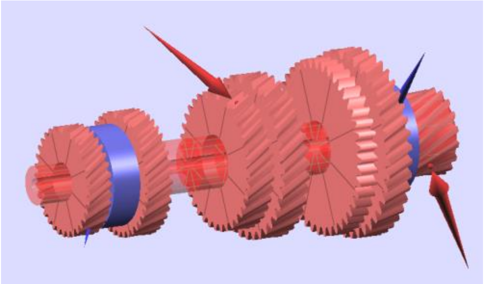
SABR is a quasi-static transmission structural program for the design and analysis of shaft, bearing, and geared systems

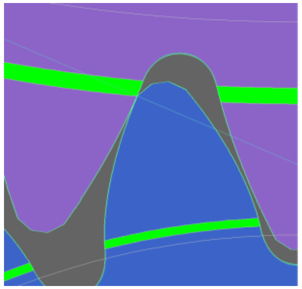
- Rapid modelling, solver speed, and stability combined with geometric warnings and guidelines makes SABR users highly productive for minimal cost

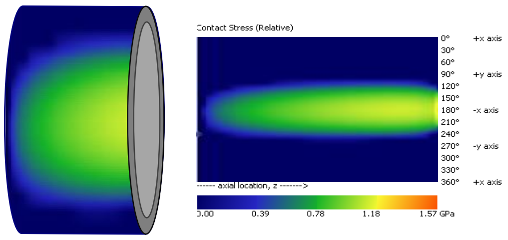
Concept Design → Detailed Design → Problem Solving

- Easy to use
- Multi-core processing for solving completed in seconds









Intuitive	*Fast*	*Immediate Feedback*	*Productive*

SABR provides analysis capabilities for the design and optimisation of shafts, bearings and gears

Shaft Design

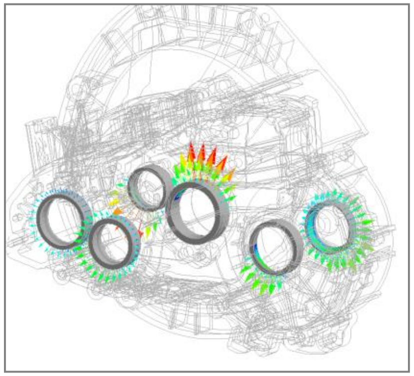
Bearing Selection and Preload

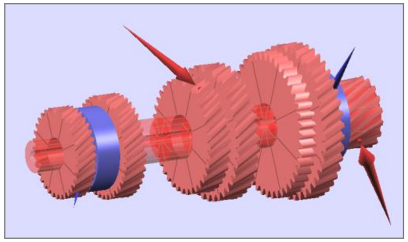
Gear Design

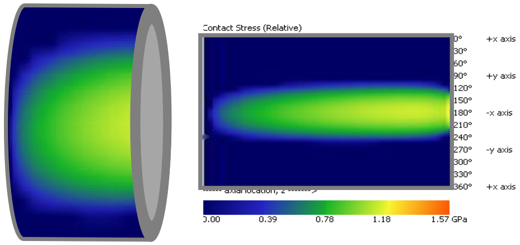
Gearbox Stiffness

Lubricant Selection

Duty Cycle Damage Assessment



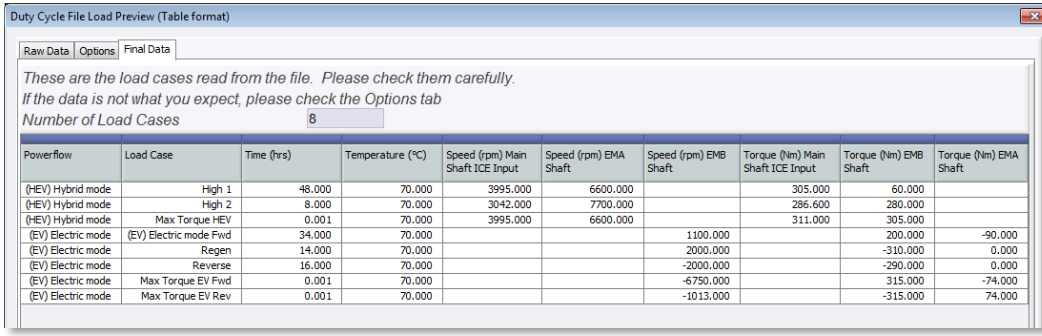




New Features

capability

- Import Duty Cycle now supports multiple Input/Output shafts



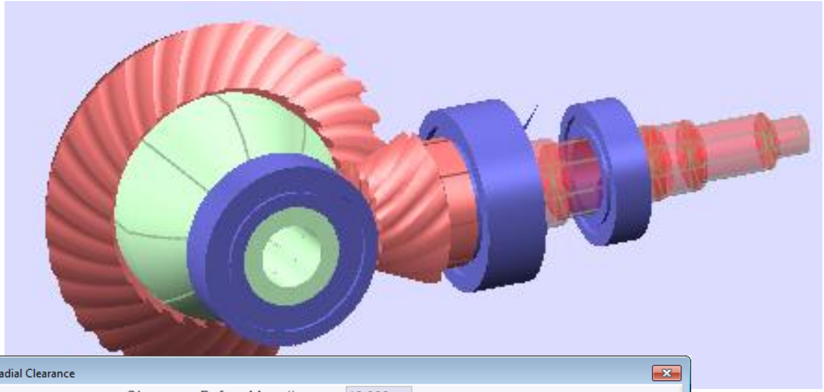
Duty Cycle File Load Preview (Table format)

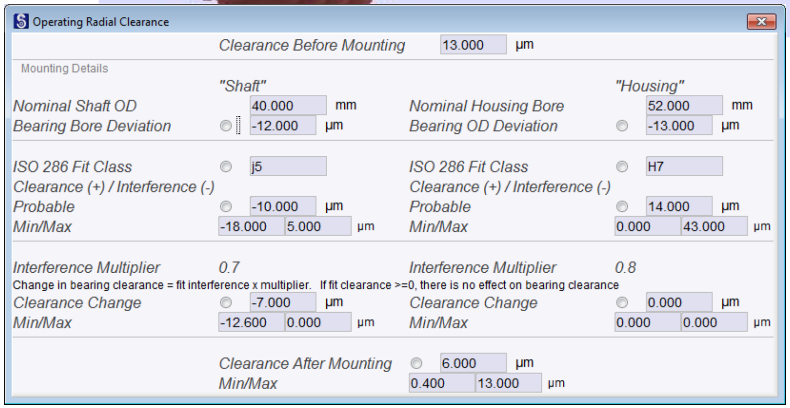
Raw Data | Options | Final Data

These are the load cases read from the file. Please check them carefully.
If the data is not what you expect, please check the Options tab
Number of Load Cases 8

Powerflow	Load Case	Time (hrs)	Temperature (°C)	Speed (rpm) Main Shaft ICE Input	Speed (rpm) EMA Shaft	Speed (rpm) EMB Shaft	Torque (Nm) Main Shaft ICE Input	Torque (Nm) EMB Shaft	Torque (Nm) EMA Shaft
(HEV) Hybrid mode	High 1	48.000	70.000	3995.000	6600.000		305.000	60.000	
(HEV) Hybrid mode	High 2	8.000	70.000	3042.000	7700.000		286.600	280.000	
(HEV) Hybrid mode	Max Torque HEV	0.001	70.000	3995.000	6600.000		311.000	305.000	
(EV) Electric mode	(EV) Electric mode Fwd	34.000	70.000			1100.000		200.000	-90.000
(EV) Electric mode	Regen	14.000	70.000			2000.000		-310.000	0.000
(EV) Electric mode	Reverse	16.000	70.000			-2000.000		-290.000	0.000
(EV) Electric mode	Max Torque EV Fwd	0.001	70.000			-6750.000		315.000	-74.000
(EV) Electric mode	Max Torque EV Rev	0.001	70.000			-1013.000		-315.000	74.000

- Hypoid Gears – Forces and misalignment calculation
  - All 4 ISO methods of calculation implemented
    - Geometry and Loads to ISO 23509
    - Misalignments to SAE 750152





- Faster loading of custom lubricants