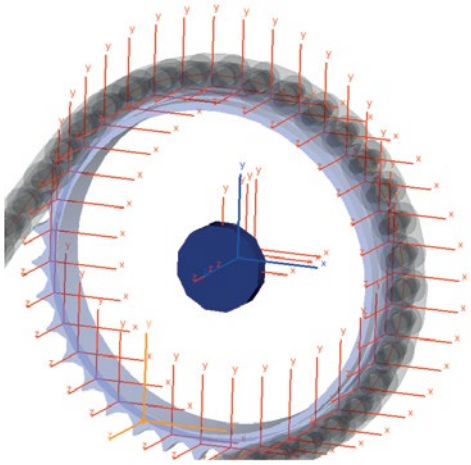

Fig 1: Flexible chain wheel

Flexible Chain Wheel and Elasto-Hydrodynamic Bearing

SIMPACK ENGINE ENHANCEMENTS

- **Improved flexible body integration for SIMPACK Chain to model flexible wheels.**
- **Complete new hydrodynamic bearings module to model (radial) journal bearings.**

FLEXIBLE CHAIN WHEELS

The SIMPACK Chain module enables the user to model chain drive systems with a high level of detail, e.g., for timing chain applications.

The module has been enhanced with the possibility to model flexible chain wheels by incorporating similar technology already used for flexible chain guides. This new functionality is available for roller and silent chains.

The flexible wheel body has to contain master nodes for each tooth where, in the MBS system, the forces acting on the wheel will be applied. The master nodes should be coupled to the wheel mesh using multi point constraints.

Within SIMPACK, the user simply has to switch the wheel body from rigid to flexible. SIMPACK will then detect the flexible wheel and automatically search for the master nodes located on the chain wheel. No further user interaction is required. The settings in the body (e.g., number of modes) should be chosen such that the desired flexible behavior of the wheel is captured.

Application scenarios are chain wheels with lightweight design affecting the dynamics of the system or stress/strain analysis on the chain wheel itself.

The required modules are SIMPACK Chain and FlexModal.

(ELASTO-)HYDRODYNAMIC BEARINGS

Hydrodynamic bearings play an important role in many MBS applications: in the engine sector, crankshaft and camshaft bearings as well as connecting rod bearings are usually designed as hydrodynamic bearings. They are also used for planetary gear bearings in the wind energy sector or shaft bearings in turbine applications.

"The Simpack Chain module enables the user to model chain drive systems..."

With version 9.8, SIMPACK now offers an easy-to-use and powerful solution to model hydrodynamic bearings. This module provides multiple levels of detail to model radial bearings:

- A simple and fast approximating method covers the dynamic behavior of the bearings and proper force application on shell and journal body.
- Based on an online solution of the Reynolds equation, the hydrodynamic method additionally provides detailed bearing internal results such as gap function, pressure distribution and the possibility to include mixed lubrication.
- Based on standard SIMPACK flexible bodies, the local deformation of shell and/or journal can be taken into account for the determination of the gap function using the elasto-hydrodynamic method.

The module consists of a primitive containing the bearing geometry and a force element. The user can define special design elements such as oil bore or groove, crush relief or arbitrary bearing profiles. With the new material type 'lubricant' the user can include temperature or pressure dependent viscosity or non-newtonian behavior for the oil within the bearing. Surface roughness of the bearing parts can be considered for the hydrodynamic flow as well as for the mixed lubrication effects.

Special emphasis was put on ease-of-use in the GUI as well as in flexible body handling. Element specific plots in the primitive GUI allow the user to quickly check the geometry input.

This new functionality enables the SIMPACK user to easily model hydrodynamic bearings and quickly adapt the level of detail depending on the application. We will further enhance the module in future releases to other bearing types such as axial thrust bearings or piston-liner couplings.

The functionality is licensed with module journal bearing (including only approximative solution) and EHD.

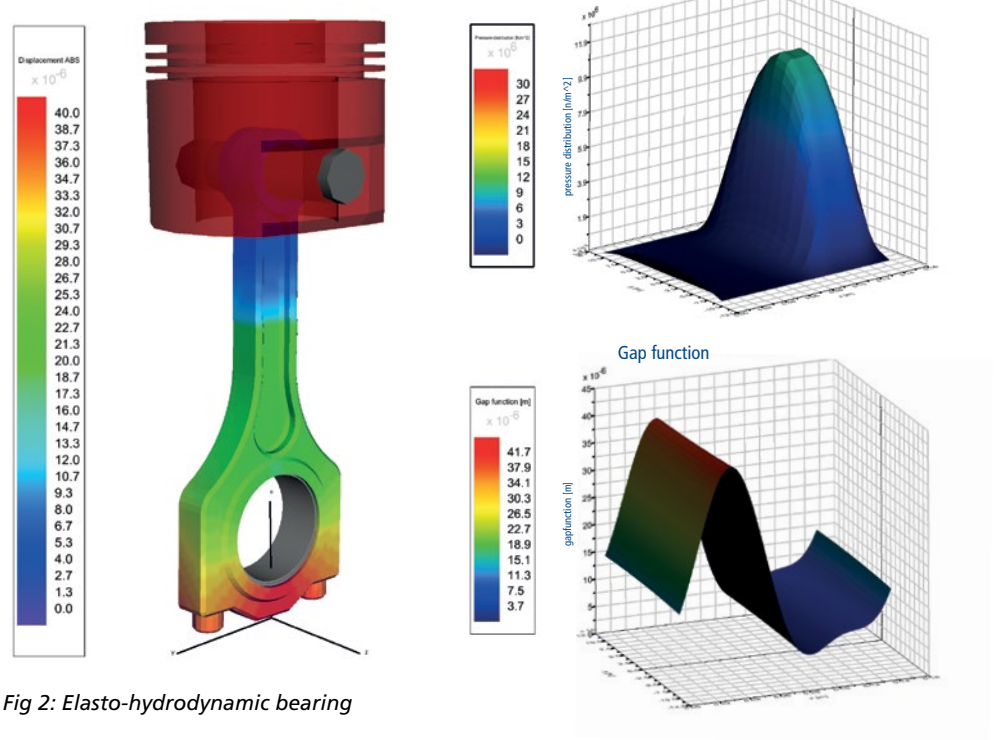

Fig 2: Elasto-hydrodynamic bearing