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Title: Modeling and design of the cylinder block/valve plate interface

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Abstract:

The lubricating gap between the cylinder block and valve plate serves to seal the individual displacement chambers and to provide a combined hydrostatic-hydrodynamic axial sliding bearing that supports the cylinder block. On the other hand, this lubricating gap is one of the primary sources of energy dissipation in axial piston machines. Therefore, the prediction of the gap flow, the load carrying ability and the energy dissipation is necessary for the design and the development of hydrostatic pumps and motor with higher efficiency rates and simultaneously a high service life.

A novel fully coupled model for the determination of cylinder block / valve plate gap behavior has been developed, considering the CFD solution of the non isothermal flow in the gap, the squeeze film effect due to the micro-motion of the moveable parts and elastic deformation of the solid bodies caused by the fluid pressure field.

The geometric complications due to the presence of openings and grooves of complex shape, that change their position during time according to machine shaft rotation, has been solved with a new efficient mesh engine that can generate a non uniform structured grid directly from the STL geometric definition of the machine. The computation domain and boundary conditions are then automatically changed respect to shaft position.

The high geometric level of detail allows also performing advanced analysis considering the micro-shape of the parts surfaces and their impact on the power losses.