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论文

流体属性可变的水压轴向柱塞泵压力流量模型

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摘要:

考虑了由于水的高饱和蒸汽压引起的空化及水的主要流体属性随压力变化的特性, 建立了水压轴向柱塞泵的压力流量特性模型。以研制的水压轴向柱塞泵样机为例在MATLAB/Simulink环境下编程仿真, 分析了泵的压力、流量和空化等特性。研究表明: 泵入口压力较低时会引起排水流量的下降, 在吸水区的缸体柱塞腔内出现明显的空化, 泵出口的流量脉动和压力脉动大幅增加; 提高泵的入口压力能够减小缸体柱塞腔内的空化程度, 此时空化主要发生在由排水向吸水变换的瞬间; 泵的内泄漏主要以滑靴副和配流副的泄露为主, 柱塞副的泄露可以忽略。

关键词: 水液压; 轴向柱塞泵; 压力; 流量; 建模; 仿真

Pressure and flow characteristic modeling of water hydraulic axial piston pump based on variable fluid properties

Abstract:

Considering cavitation due to the high saturation vapor pressure of water and main fluid properties variation with pressure, a mathematical model of the dynamic pressure and flow characteristics of a water hydraulic axial piston pump was built. The model was programmed in a MATLAB/Simulink platform and a prototype of water hydraulic pump was simulated as an example. The pressure, flow and cavitation characteristics of the prototype were analyzed based on simulation results. The investigation shows that the average discharge flow of the pump will decrease, obvious cavitation will occur in the cylinder chambers that are in suction process, flow and pressure ripple will be severe when the inlet pressure is low. As the inlet pressure increases, the cavitation in the cylinder chambers will reduce and only occur in transition regions between discharge and suction. The internal leakage of the pump is mainly due to the gap flow of the slipper/swash plate combination and the cylinder block/valve plate combination, and the effects of the piston/cylinder-block can be ignored.

Keywords: water hydraulics; axial piston pump; pressure; flow; modeling; simulation

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