

عنوان مقاله:

Fluid Dynamic Characteristics and Flow Distribution Structure Optimization of Axial Piston Pump Considering Cavitation Bubble Evolution

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خلاصه مقاله:

An axial piston pump can produce a serious cavitation phenomenon in the high- and low-pressure transition process. Cavitation bubbles expand, compress, rebound and collapse when they enter the high-pressure oil drainage area. This affects the outlet flow ripple as well as the pressure pulsation of the piston pump. However, the effect of the cavitation bubbles is ignored in the current outlet flow ripple model of axial piston pumps. It affects the optimization design of the axial piston pump distribution area structure parameters with the objective of reducing the pressure and flow rate. Therefore, a method of optimizing the fluid dynamic characteristics and the flow distribution area structure parameters of an axial piston pump considering the cavitation bubble evolution is proposed. A single-cavity dynamic model was established to study the bubble evolution as the piston chamber pressure changes. According to the cavitation cloud (group cavitation) characteristics of the axial piston pump, theoretical models of the outlet flow ripple and the pressure pulsation of a piston pump were established considering the cavitation bubble characteristics. The influence of cavitation characteristics on the outlet flow ripples and pressure pulsation of the axial piston pump was analyzed and compared with that without cavitation. Comparison with the experimental results, verified that the outlet flow ripple model becomes more accurate when cavitation bubble characteristics are considered. Based on the multi-agent particle swarm optimization (MAPSO) algorithm, an optimization model of the piston pump outlet flow ripple was established considering the cavitation bubble characteristics. The optimized design parameters for the flow distribution area of the axial piston pump were evaluated. The proposed method can provide theoretical guidance for the design of a low flow ripple axial piston pump.

کلمات کلیدی:

Axial piston pump, Cavitation bubble, Flow ripple, MSPOS, Optimization

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