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机械-液压双元动力发动机锥形配流阀的优化

Optimal design for cone valve of mechanical-hydraulic dual power engine

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英文关键词: [optimization](#) [internal combustion engines](#) [pumps](#) [mechanical-hydraulic dual power engine](#) [cone valve](#) [volume efficiency](#)

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中文摘要:

机械-液压双元动力输出发动机(MHPE)将传统的内燃机和柱塞泵融为一体,可同时或单独输出机械、液压2种动力。MHPE采用锥形阀配流系统,其容积效率高影响MHPE的整机性能。该文以容积效率为目标函数,以锥形阀的工作条件和结构尺寸为约束条件,以MHPE锥形阀的结构参数为优化变量,建立了优化模型,并基于T软件进行优化设计。优化结果表明,优化后系统的容积效率提高5.71%,改善程度较大。

英文摘要:

Abstract: Heat energy can be converted to hydraulic energy by a traditional engine-pump system (EPS). However, the EPS has some disadvantages, such as a long transmission line, low efficiency, and a complex and heavy structure. With an integrating traditional internal combustion engine and plunger pump to remove intermediate links, a mechanical-hydraulic dual power engine (MHPE) can convert heat energy to hydraulic energy directly. Therefore, the energy conversion efficiency was improved and the structure was simplified. MHPE can output one of or both machinery and hydraulic powers, and it can be used for excavators, loaders, bulldozers, and other engineering machineries. The distribution valve is an important element of MHPE, can affect the volume efficiency of the system directly by its structure and performance. The 36114ZG4B type six-cylinders radial MHPE was developed. A-H20L type one-way cone valve with the valve disk of 0.07557 kg quality, 0.028 m large diameter, 0.021 m small diameter and 40° angle is used as an inlet valve. A DIF-L20H type one-way cone valve with the valve disk of 0.04672 kg quality, 0.021 m large diameter, 0.016 m small diameter and 45° angle was used as an outlet valve. With the volume efficiency taken as an objective function, the cone valve's working conditions and structure dimensions taken as constraint conditions, and the cone valve's structure parameters taken as optimization variables, an optimization model was established. Based on Adolph's no-impact theory of pump valve, a valve disk's speed cannot exceed the maximum allowable speed in order to guarantee the normal work of the valve cone, the hydraulic oil's flow rate through valve clearance is not allowed to exceed 6 m/s. iSIGHT software was used to optimize the cone valve's structure with the inlet valve disk result of 0.04076 kg, 0.036 m large diameter, 0.028 m small diameter, and 46° angle as well as the outlet valve disk result of 0.05845 kg, 0.028 m large diameter, 0.021 m small diameter and 49° angle. At the same time, the volume efficiency of the system was simulated and has been found to increase significantly with the optimization: the volume efficiency increased by 5.71% to the maximum point, 98.06%, at about 1300 r/min; the volume efficiency of the system decreased when the rotate speed exceeded 1300 r/min, which is due to the cone valve's natural frequency is close to the integer times of the operating frequency of the system; and the volume efficiency is stable in a common condition area, which was from 1200 to 1400 r/min.

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