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反应堆工程

水压缸活塞环密封运动阻力研究

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摘要 针对控制棒水压驱动机构单缸步进动态过程，根据水压缸活塞环密封机构的特点，分析水压缸单缸步进过程中运动阻力的来源，建立运动过程的动态理论模型。利用控制棒水压驱动机构单缸性能实验的结果，推导出水压缸单缸步进过程中运动阻力的变化过程。通过对运动阻力参数和步进过程中缸内压力以及步升速度动态参数的分析，得到了水压缸单缸步进过程中运动阻力的计算模型。由该模型计算所得步进动态位移曲线与控制棒水压驱动机构单缸步进实验位移曲线吻合得很好。本研究结果为控制棒水压驱动机构单缸步进过程的动态模拟以及控制棒水压驱动机构在步进过程中各部件的应力分析奠定了理论基础。

关键词 控制棒水压驱动机构；水压缸；活塞环；运动阻力

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Kinetic Resistance of Hydraulic Cylinder Piston Ring Seal Structure

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Abstract According to the step motion of single cylinder for Control Rod Hydraulic Drive Mechanism (CRHDM) and the characteristics of the hydraulic cylinder piston ring seal structure, the source of kinetic resistance during step motion process was analyzed, the theoretical model of the dynamic step motion process was built and the value of kinetic resistance based on the results of the control rod hydraulic drive mechanism single cylinder experiment was deduced. By analyzing the relationship between kinetic resistance and the dynamic parameters of the step motion process including the pressure and the velocity of the inner cylinder, calculation model of the kinetic resistance during the step motion process was obtained. The displacement curve inferred from this model agrees with the experimental data. This model would be helpful for the dynamic simulation of the step motion process and the stress analysis of the control rod hydraulic drive mechanism.

Key words control rod hydraulic drive mechanism; hydraulic cylinder; piston ring; kinetic resistance

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