

反应堆工程

# 控制棒水压驱动机构液压缸步降过程运动阻力研究

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**摘要** 液压缸是控制棒水压驱动机构的主要部件, 液压缸的动作包括步升过程和步降过程, 液压缸步降运动阻力是液压缸结构设计和步降运动分析的关键参数。对液压缸步降过程进行了理论分析, 建立了步降过程动态理论模型。在此基础上, 结合控制棒水压驱动机构单缸性能实验结果, 得到了液压缸步降速度和步降加速度, 进而推导出两种液压缸运动阻力模型。对两种阻力模型及其计算结果进行了对比, 结果表明, 在实验工况下, 模型计算所得步降动态位移曲线与实验曲线符合较好。同时, 基于步降加速度的阻力模型中运动阻力是缸内套步降速度以及缸内压力的函数, 函数中系数项与配重关系明显, 更加适合于工程计算和推广。

**关键词** [控制棒水压驱动机构](#); [液压缸](#); [运动阻力](#); [步降运动](#)

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## Kinetic Resistance of Hydraulic Cylinder for Control Rod Hydraulic Drive Mechanism in Step-Down Motion Process

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**Abstract** Hydraulic cylinder is the main component of the control rod hydraulic drive mechanism (CRHDM). Step-up and step-down motions are the functions of hydraulic cylinder. The kinetic resistance of hydraulic cylinder during step-down motion is the key parameter in the hydraulic cylinder structure design and step-down analysis. Theoretical analysis of hydraulic cylinder step-down process was carried out to establish the dynamic model of the process. The step-down velocity and acceleration were obtained by combining the step-down dynamic model and the results of the CRHDM single cylinder experiment, which lead to two sets of step-down kinetic resistance models. Comparison of these two models and their calculation results shows that, under the experimental conditions, the displacement curves inferred from these models agree with the experimental data. And in the model based on step-down acceleration the kinetic resistance is the function of inner cylinder's velocity and the hydraulic pressure inside the cylinder, the relationship of the coefficients in the model to the loadings is easy to obtain, so the kinetic resistance model based on step-down acceleration is more applicable to engineering use and extension.

**Key words** [control rod hydraulic drive mechanism](#) \_ [hydraulic cylinder](#) \_ [kinetic resistance](#) \_ [step-down motion](#)

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