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DYNAMIC RESPONSE OF DRILLING AND FEEDING MECHANISM OF LUNAR SOIL SAMPLING DRILLER

Abstract

The feeding motion of the lunar soil sampling driller is implemented by wire rope, whose transmission feature and space adaptability are analyzed. The transmission mechanism using wire rope is regarded as a rigid-flexible coupling and large displacement servo feeding system. The equivalent stiffness model of the slender drill pipe is calculated. Considering the influence of the wind style on the dynamics properties of the system, the dynamics model of the drilling and feeding mechanism using wire rope is provided. And three DOF Lagrange equations with energy dissipation are established. Then the differential equations are solved by Runge-Kutta method. A kind of typical load spectrum of rotary drilling with impact is obtained. The impact factors and critical parameters of feeding accuracy of the drill bit are studied by simulations in detail. The results indicate that the fluctuant load of the drill bit may provoke a narrow range longitudinal vibration because of the elasticity of the wire rope and the drill pipe. However, the wire rope with higher stiffness could inhibit the vibration evidently. The vibration could also be reduced on the moon due to the lower gravity. And the pre-tighten force of wire rope could suppress the vibration effectively in the pre-tighten stage. However, when the pre-tighten force exceeds certain definite value (e.g. 2000N), the vibration will become more apparent. The transmission system is rigidified. And the outside impact could be transferred to the lander, which ought to be avoided.