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微纳技术与精密机械

步进快速限幅摆式陀螺寻北仪

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摘要：针对摆式陀螺寻北仪存在的限幅效率低的工程实际问题，提出了一种步进快速限幅方法，介绍了该方法的实现原理和步骤，分析了3种主要测量误差对限幅效果的影响，论证了步进快速限幅法在理论上的可行性，最后将步进快速限幅法成功应用于摆式陀螺寻北仪上。设计了相应的限幅试验，利用摆动的平衡位置主动跟踪逆转折点，实现了对摆幅的快速精确限制。理论和试验结果均表明：提出的步进快速限幅法保留了传统步进法不需要增加系统硬件的优点，有效克服了采用电磁阻尼法限幅时电磁干扰力矩的问题，保持了限幅的可靠性。基于步进快速限幅方法的摆式陀螺寻北仪能在一个步进周期（约60 s）内实现对摆幅的快速精确限制，较传统步进法可以节省2个以上的步进周期，为缩短寻北时间提供了理论支撑和实践依据。

关键词：摆式陀螺寻北仪 步进快速限幅法 电磁阻尼法 摆幅

Stepped and fast limiting pendulous gyroscope

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Abstract: A stepped and fast limiting method to allow the equilibrium position of a swing to track the turning point was put forward for improving the limiting efficiency of pendulous gyroscopes. The working principle and achieving steps were introduced and the influences of three types of measurement errors on the limiting effect were analyzed. Then the feasibility of the proposed limiting method was demonstrated in theory. Finally, the method was applied to a pendulous gyroscope, and the swing range was limited exactly and rapidly by using the equilibrium position of the swing to track the turning point. The limiting experiment was designed based on the proposed limiting method. The theory and experiment results show that the new method has overcome the electromagnetic interference torque problem from the electromagnetic damping method and can keep the limiting reliability without adding system hardware. The pendulous gyroscope can just spend about 60 s to limit the swing, which saves more than 2 step periods than traditional one. This method can provide a theoretical support and practical basis for shortening the time of north seeking.

Keywords: Pendulous gyroscope Stepped and quickly limit method Electromagnetic damping method Swing range

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