管道地理坐标测量误差校正方法的研究

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摘 要：

设计采用轻便的低精度MEMS惯性器件搭载管道清管器的方法实现管道地理坐标的内检测，由于器件精度较低，惯导算法的误差不断累积，不能满足定位要求。根据这一问题，通过里程轮校准检测器的速度，通过重锤校准检测器的姿态角，里程轮和重锤的误差不会累积，可以提高定位的精度；采用误差补偿方法，建立了姿态，速度和位置的误差模型，将里程轮和重锤的输出与惯导计算的误差值作为观测量，建立观测方程；误差模型利用倾角表示姿态角误差，产生非线性问题，为此，采用无迹卡尔曼滤波方法，在惯导算法中对滤波估计的误差进行补偿。结果表明，利用该算法可以降低误差的影响，实现管道地理坐标测量的管道内检测，具有一定的应用价值。

关键词：管道地理坐标测量；内检测；离线分析；捷联惯导；卡尔曼滤波

Research on the error correction methods of the Pipeline's Geographic Coordinate Measuring

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Abstract:

The design used the low accuracy inertia components equipped with the pipeline cleaner to measure the geographic coordinate, the inertia algorithm error was accumulated Over and over, thus it can not fulfill the location requirements. Aim at the issue, we calibrate the instruments' speed through the odometers, calibrate the instruments' attitude angle through the pendulums. Because the errors of the odometers and the pendulums can not be accumulated, the method can increase the location accuracy; We use the error compensation methods, deduced the error model of the attitudes, speed and positions. We subtracted the odometers and pendulums' outputs form the inertia algorithm results, took the errors as the observed values, deduce the observed equations; As the errors' models were nonlinear equations, we used the unscented kalman filtering methods, compensated the estimated errors from the filtering in the inertial navigation algorithm. The results showed that the methods can decrease the errors' influences, and achieve the pipeline's geographic coordinates under the condition that detecting in the pipeline. It has certain value in practice.

Keywords: geographic coordinate measuring；pipeline inspect；Off-line analysis； Inertial navigation；kalman filter

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