Integration of Inertial Navigation System and Global Positioning System: Performance analysis and measurements

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Abstract: Navigation and guidance are very important problems for marine, aeronautics and space technology. In such systems, Inertial Measurement Units (IMUs) are widely used as the core of the Inertial Navigation Systems (INS). Due to the strong growth of MEMS technology, the INS is widely applied to navigation and guidance of aircraft movements. However, there are existing errors in the accelerometer and gyroscope signals that cause unacceptable drifts. In this paper, we have determined noise parameters of both deterministic and stochastic errors of MEMS based the IMUs. For the deterministic errors, the calibration process is not quite difficult. For the stochastic errors, we have tried two different methods PSD and Allan variance. The PSD is known as a classical method to analyze signal, while Allan variance is a new method which can show more information than the PSD. Combining these two methods will give us a reliable noise model that is applied directly to the Kalman Filtering Block (KFB). In the case the random noise drifts that can not be compensated for are to be taken into account while performing an error analysis, this paper also presents a in motion alignment evaluation. ??2007 IEEE.

Index Keywords: Aerospace industry; Air navigation; Aircraft; Control theory; Error analysis; Errors; Inertial navigation systems; MEMS; Microelectromechanical devices; Navigation systems; Power spectral density; Pulse shaping circuits; Semiconductor switches; Aircraft movements; Allan variances; Calibration processes; Classical methods; Inertial Measurement units; MEMS technologies; Motion alignments; Noise models; Noise parameters; Performance analyses; Random noises; Space technologies; Stochastic errors; Strong growths; Two different methods; Units of measurement

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