

Procedure for Effortless In-Field Calibration of Three-Axis Rate Gyros and Accelerometers

Franco Ferraris, Ugo Grimaldi and Marco Parvis

Department of Electronics, Technical University of Torino
Corso Duca degli Abruzzi, 24 10129 Torino, Italy

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The contemporaneous use of three-axis rate gyros and accelerometers is required in industrial applications, such as strap-down platforms used for inertial vehicle navigation. The use of low-cost sensors often makes it necessary to perform the sensor calibration in-field immediately before use. Unfortunately, typical calibration methods make use of complex equipment which is impractical for in-field use. We describe a procedure for calibrating both three-axis rate gyros and accelerometers, which is suitable for in-field use. The rate gyro calibration does not require either rotating tables or other velocity standards and refers only to geometrical quantities. The accelerometer calibration conventionally uses the local gravity as the standard and does not further require any special-purpose instrumentation, except for that already required for sensor use. The calibration procedure is simply based on a set of rotations of the case which contains the sensors. The required signal processing can be carried out using the A/D conversion system and the computing system already used to process the sensor outputs. The entire procedure leads to the simultaneous calibration of the two sensors. It lasts only a few minutes and allows the determination of the bias, the scale factor and the orientation of the sensors, in addition to the main parameters of the complete measuring chain, including the signal conditioning devices and the A/D converter. The procedure proposed is particularly useful in applications to vehicle prototype testing; such applications often involve inertial vehicle navigation, which must be performed during a long series of short tests. Such a test pattern is attractive for the proposed coupling of in-field calibration and low-cost sensors.