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Autore	Bekir Esmat
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4.6 The Craft Rate n in 4.7 Solution of the DCM n in C ; 4.8 Gravitational and Gravity Fields; 5. The Inertial Navigation System Equations; 5.1 Introduction; 5.2 Body Frame of Reference; 5.3 Inertial Sensors; 5.3.1 The Accelerometer; 5.3.2 The Rate Gyro; 5.4 The Attitude Equation; 5.5 The Navigation Equation; 5.6 Navigation Equations Computational Flow Diagram; 5.7 The Navigation Equation in Earth Frame; 6. Implementation; 6.1 Introduction; 6.2 The Rotation Vector Differential Equation; 6.3 The Attitude Equation; 6.4 The Craft Velocity Equation; 6.5 The Craft Position Equation; 6.6 The Vertical Channel; 7. Air Data Computer; 7.1 Introduction; 7.2 US Standard Atmosphere 1976; 7.3 Pressure Altitude; 7.4 Vertical Channel Parameter Estimation Using Inertial and Air Data; 7.5 Density Altitude; 7.6 Altitude (Descend/Climb) Rate; 7.7 Air Speed; 7.8 Indicated Air Speed (IAS); 8. Polar Navigation; 8.1 Introduction; 8.2 The Wander Azimuth Navigation; 8.3 Prospective of the Wander Azimuth Approach; 8.4 Polar Circle Navigation Algorithm; 8.5 Alternative Polar Circle Navigation Frame; 9. Alignment; 9.1 Introduction; 9.2 IMU Alignment; 9.3 Alternative Algorithm for b in C ; 9.4 Estimation of the Accelerometer and Gyro Biases; 9.5 Effects of Biases on Estimate of b in C ; 10. Attitude and Heading Reference System; 10.1 Introduction; 10.2 Attitude Initialization; 10.3 Heading Initialization; 10.4 Gyro Drift Compensation; 10.5 G Slaving; 10.5.1 X-Gyro Bias; 10.5.2 Y-Gyro Bias; 10.5.3 Z-Gyro Bias; 10.6 Alternative Approach for Gyro Drift Compensation; 10.7 Maneuver Detector; 10.7.1 Rate Gyro Threshold Selection; 11. GPS Aided Inertial System; 11.1 Introduction; 11.2 Navigation Frame Error Equation; 11.2.1 Craft Rate Error n in en ; 11.2.2 Earth Rate Error n in ie ; 11.2.3 Position Errors

Sommario/riassunto

The emerging technology of very inexpensive inertial sensors is available for navigation as never before. The book lays the analytical foundation for understanding and implementing the navigation equations. It starts by demystifying the central theme of the frame rotation using such algorithms as the quaternions, the rotation vector and the Euler angles. After developing navigation equations, the book introduces the computational issues and discusses the physical aspects that are tied to implementing these equations. The book then explains alignment techniques.

Introduction to Modern Navigation