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Nota di contenuto	Preface; Contents; Introduction; 1. Vectors and Matrices; 1.1 Introduction; 1.2 Vector Inner Product; 1.3 Vector Cross Products and Skew Symmetric Matrix Algebra; 2. Coordinate Transformation between Orthonormal Frames; 2.1 Introduction; 2.2 Direction Cosine Matrices; 2.3 The Direction Cosine Matrix is a Unitary Matrix; 2.4 The Direction Cosine Matrix is a Transformation Matrix; 2.5 DCM Fixed Axis; 2.6 The Rotation Matrix; 2.7 Inner and Outer Transformation Matrices; 2.8 The Quaternion; 3. Forms of the Transformation Matrix; 3.1 Introduction; 3.2 Simple Frame Rotations; 3.3 Euler Angles 3.4 Rotation Vector3.5 Quaternion; 3.6 Simple Quaternions; 3.7 Conversion between Forms; 3.7.1 Conversion between DCM and Euler; 3.7.2 Conversion between DCM and Quaternion; 3.7.3 Conversion between Euler Angles and Quaternion; 3.8 Dynamics of the Transformation Matrix; 3.8.1 DCM Differential Equation; 3.8.2 Quaternion Differential Equation; 3.8.3 Rotation Vector Differential

Equation; 3.8.4 Euler Angles Differential Equation; 4. Earth and Navigation; 4.1 Introduction; 4.2 Earth, Geoid and Ellipsoid; 4.3 Radii of Curvature; 4.4 Earth, Inertial and Navigation Frames; 4.5 Earth Rate; 4.6 The Craft Rate n in e ; 4.7 Solution of the DCM n in e ; 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 e ; 11.2.2 Earth Rate Error n in e ; 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

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Sommario/riassunto	Combinatorial mathematicians and statisticians have made a wide range of contributions to the development of block designs, and this book brings together much of that work. The designs developed for a specific problem are used in a variety of different settings. Applications include controlled sampling, randomized response, validation and valuation studies, intercropping experiments, brand cross-effect designs, lotto and tournaments. The intra- and inter- block, nonparametric and covariance analysis are discussed for general block designs, and the concepts of connectedness, orthogonality, and