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Nota di contenuto	Structural Health Monitoring; Table of Contents; Foreword; Chapter 1. Introduction to Structural Health Monitoring; 1.1. Definition of Structural Health Monitoring; 1.2. Motivation for Structural Health Monitoring; 1.3. Structural Health Monitoring as a way of making materials and structures smart; 1.4. SHM and biomimetics; 1.5. Process and pre-usage monitoring as a part of SHM; 1.6. SHM as a part of system management; 1.7. Passive and active SHM; 1.8. NDE, SHM and NDECS; 1.9. Variety and multidisciplinary: the most remarkable characters of SHM 1.10. Birth of the Structural Health Monitoring Community1.11. Conclusion; 1.12. References; Chapter 2. Vibration-Based Techniques

for Structural Health Monitoring; 2.1. Introduction; 2.2. Basic vibration concepts for SHM; 2.2.1. Local and global methods; 2.2.2. Damage diagnosis as an inverse problem; 2.2.3. Model-based damage assessment; 2.3. Mathematical description of structural systems with damage; 2.3.1. General dynamic behavior; 2.3.2. State-space description of mechanical systems; 2.3.3. Modeling of damaged structural elements; 2.4. Linking experimental and analytical data 2.4.1. Modal Assurance Criterion (MAC) for mode pairing 2.4.2. Modal Scaling Factor (MSF); 2.4.3. Co-ordinate Modal Assurance Criterion (COMAC); 2.4.4. Damping; 2.4.5. Expansion and reduction; 2.4.6. Updating of the initial model; 2.5. Damage localization and quantification; 2.5.1. Change of the flexibility matrix; 2.5.2. Change of the stiffness matrix; 2.5.3. Strain-energy-based indicator methods and curvature modes; 2.5.4. MECE error localization technique; 2.5.5. Static displacement method; 2.5.6. Inverse eigensensitivity method; 2.5.7. Modal force residual method 2.5.8. Kinetic and strain energy-based sensitivity methods 2.5.9. Forced vibrations and frequency response functions; 2.6. Solution of the equation system; 2.6.1. Regularization; 2.6.2. Parameter subset selection; 2.6.3. Other solution methods; 2.6.4. Variances of the parameters; 2.7. Neural network approach to SHM; 2.7.1. The basic idea of neural networks; 2.7.2. Neural networks in damage detection, localization and quantification; 2.7.3. Multi-layer Perceptron (MLP); 2.8. A simulation example; 2.8.1. Description of the structure; 2.8.2. Application of damage indicator methods 2.8.3. Application of the modal force residual method and inverse eigensensitivity method 2.8.4. Application of the kinetic and modal strain energy methods; 2.8.5. Application of the Multi-Layer Perceptron neural network; 2.9. Time-domain damage detection methods for linear systems; 2.9.1. Parity equation method; 2.9.2. Kalman filters; 2.9.3. AR and ARX models; 2.10. Damage identification in non-linear systems; 2.10.1. Extended Kalman filter; 2.10.2. Localization of damage using filter banks; 2.10.3. A simulation study on a beam with opening and closing crack; 2.11. Applications 2.11.1. I-40 bridge

Sommario/riassunto

This book is organized around the various sensing techniques used to achieve structural health monitoring. Its main focus is on sensors, signal and data reduction methods and inverse techniques, which enable the identification of the physical parameters, affected by the presence of the damage, on which a diagnostic is established. Structural Health Monitoring is not oriented by the type of applications or linked to special classes of problems, but rather presents broader families of techniques: vibration and modal analysis; optical fibre sensing; acousto-ultrasonics, using piezoelectr