SYSTEMS HEALTH MANAGEMENT
Framework and Applications

Subjects

1) FUNDAMENTALS

1.1: Background and objectives
- 1.1.1: General considerations
- 1.1.2: Paradigm shift
- 1.1.3: Application areas
- 1.1.4: Summary of benefits

1.2: Definitions
- 1.2.1: Basic definitions
- 1.2.2: Fault management definitions

1.3: Functions and requirements
- 1.3.1: SHM functional capabilities
- 1.3.2: Systems health management requirements

1.4: Reference architecture
- 1.4.1: Integrated approach to CBM/PHM design
- 1.4.2: Health management logic diagram

1.5: Enabling technologies
- 1.5.1: Summary of enabling technologies
- 1.5.2: SHM significant issues
- 1.5.3: Modeling framework
- 1.5.4: Prognostic algorithms approaches
- 1.5.5: Physics of failure

2) SENSING AND DATA PROCESSING

2.1: Transducing principles
- 2.1.1: Measurements
- 2.1.2: Validation

2.2: Sensors placement
- 2.2.1: Requirements

2.3: Virtual sensors
- 2.3.1: Definition
- 2.3.2: Example

2.4: Smart sensors
- 2.4.1: Objectives

2.5: Data processing
- 2.5.1: Requirements
- 2.5.2: Validation
- 2.5.3: Features selection and extraction
- 2.5.4: Data fusion
- 2.5.5: Signals characterization
- 2.5.6: Data rate

2.6: Use cases of signals analysis for health assessment
- 2.6.1: Effect of a fault on vibration signature

2.6.2: Gear health analysis
2.6.3: Bearings health analysis
2.6.4: Lubricant health analysis

3) PROGNOSTICS AND HEALTH MANAGEMENT

3.1: Framework
3.1.1: Definitions
3.1.2: Steps for developing a PHM system
3.1.3: FMECA
3.1.4: Elements of a PHM system
3.1.5: Applications

3.2: Methodologies for fault diagnosis
3.2.1: Fault detection strategies
3.2.2: Feature vector
3.2.3: Data diagnostic methods
3.2.4: Fault classification
3.2.5: Model based reasoning
3.2.6: Case based reasoning
3.2.7: Dynamic case based reasoning
3.2.8: Rule based systems
3.2.9: Statistical change detection
3.2.10: Bayesian networks
3.2.11: Hidden Markov models
3.2.12: Multivariate statistical methods

3.3: Methodologies for failure prognosis
3.3.1: Prediction framework
3.3.2: Model based prognostics
3.3.3: Data driven prognostics
3.3.4: Adaptive prognostics
3.3.5: Experience based prognostics

3.4: Performance metrics
3.4.1: Diagnosis and prognosis requirements
3.4.2: Diagnosis performance metrics
3.4.3: Prognosis performance metrics
3.4.4: Effectiveness metrics

3.5: Data mining
3.5.1: Definition
3.5.2: Tasks

3.6: Use case: PHM applied to electro-hydraulic flight control actuators
3.6.1: Introduction
3.6.2: Methodology
3.6.3: Modeling and simulation
3.6.4: Faults diagnosis and failure prognosis

3.7: Use case: PHM applied to electro-mechanical flight control actuators
3.7.1: EMA architecture
3.7.2: Signals analysis
3.7.3: Failure modes and their classification
3.7.4: Modeling and features identification
3.7.5: Prognostics

4) SYSTEMS HEALTH MANAGEMENT APPLIED TO VEHICLES

4.1: Introduction to Integrated Vehicle Health Management
4.1.1: Background
4.1.2: Framework

4.2: IVHM end-to-end system
4.2.1: Architecture
4.2.2: IVHM lifecycle
4.2.3: Functional model
4.2.4: Operational model

4.3: Vehicle level reasoning system
4.3.1: Fundamentals
4.3.2: Functional modules

4.4: Aircraft applications
4.4.1: 777 aircraft diagnostic and maintenance system
4.4.2: Helicopter transmission HUMS
4.4.3: Embraer AHEAD program
4.4.4: Airbus AIRMAN program

4.5: Autonomic logistic support
4.5.1: Definition
4.5.2: Application

5) CONCLUSIVE REMARKS