

PROGNOSTICS AND HEALTH MANAGEMENT: AN EMERGING TECHNOLOGY

Programma delle lezioni

1) INTRODUCTION

1.1: Background and objectives

1.1.1: General considerations

1.1.2: Paradigm shift

1.1.3: Fleet user requirements

1.2: Definitions

1.2.1: Basic definitions

1.2.2: Fault management definitions

1.3: Functions and requirements

1.3.1: Functional capabilities

1.3.2: Diagnostic and prognostic system design requirements

2) FUNDAMENTALS

2.1: Architecture

2.1.1: Approach

2.1.2: Fault progression

2.1.3: PHM logic diagram

2.1.4: PHM enabling technologies

2.2: Sensing and data processing

2.2.1: Data processing

2.2.2: Sensors suite

2.2.3: Virtual sensors

2.2.4: Sensors validation

2.3: Steps for developing a PHM system

2.3.1: Needs

2.3.2: Identify the failure modes

2.3.3: Identify the failure precursors

2.3.4: Identify the degradation paths

2.3.5: Alerting of fault progression

2.3.6: Cost effectiveness

2.4: Fault monitoring, diagnosis and prognosis framework

2.4.1: FMECA

2.4.2: PHM system elements

2.4.3: Remaining useful life prediction

2.4.4: Prognostic algorithms

3) METHODOLOGIES

3.1: Fault diagnosis

3.1.1: Fault detection strategies

3.1.2: Feature vector

3.1.3: Data diagnostic methods

- 3.1.4: Fault classification
- 3.1.5: Model-based reasoning
- 3.1.6: Case-based reasoning
- 3.1.8: Rule-based systems
- 3.1.9: Statistical change detection
- 3.1.10: Bayesian networks
- 3.1.11: Hidden Markov models
- 3.1.12: Multivariate statistical methods
- 3.2: Fault prognosis
 - 3.2.1: Prediction framework
 - 3.2.2: Model-based prognostics
 - 3.2.3: Data driven prognostics
 - 3.2.4: Experience-based prognostics
- 3.3: Performance metrics
 - 3.3.1: Diagnosis and prognosis requirements
 - 3.3.2: Diagnosis performance metrics
 - 3.3.3: Prognosis performance metrics
 - 3.3.4: Effectiveness metrics

4) APPLICATIONS

- 4.1: Application areas
 - 4.1.1: PHM in the engineering systems
 - 4.1.2: Equipments and components
- 4.2: Application examples
 - 4.3.1: Effect of a fault on vibration signature
 - 4.3.2: Health monitoring system for helicopter transmission
 - 4.3.3: Gear health analysis
 - 4.3.4: Bearings health analysis
 - 4.3.5: Lubricant health analysis

5) USE CASES

- 5.1: PHM system for electrohydraulic actuators for primary flight controls
 - 5.1.1: Background
 - 5.1.2: Virtual hardware
 - 5.1.3: Methodology
 - 5.1.4: Reasoning functions
 - 5.1.5: Prognostics
- 5.2: PHM system for electromechanical actuators for primary flight controls
 - 5.2.1: Electromechanical actuators for flight control systems
 - 5.2.2: Failure modes and their classification
 - 5.2.3: PHM strategy
 - 5.2.4: Prognosis with use of particle filtering