



Structural Health Monitoring

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Introduction

An Active Online Structural Health Monitoring System Is Developed for the In-Service Composites Using Smart Materials (Piezoelectrics), to Syncretise the Designated Functions With Self-diagnosis and Self-rehabilitation Capabilities, Based on Which the Occurrence and Severity of the Damage Can Be Quantitatively Real-Time monitored.

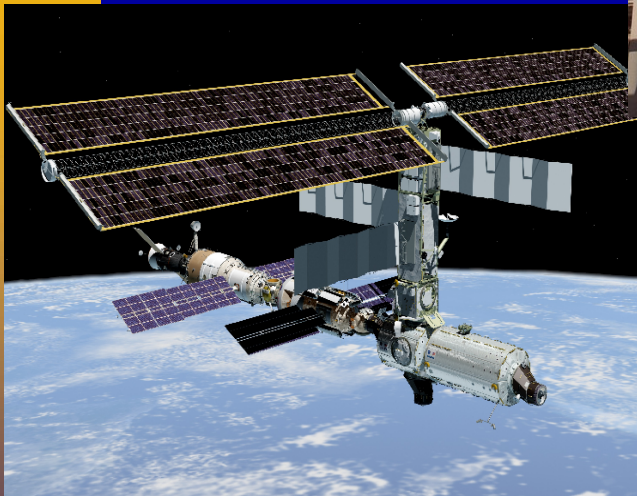
Highlights

- ✓ Digital Damage Fingerprints (DDF)
- ✓ Damage Parameters Database (DPD)
- ✓ Artificial Intelligence Algorithm
- ✓ Advanced Signal/Image Processing Algorithm
- ✓ Active Sensor/Actuator Network
- ✓ Active Real-Time Diagnosis System



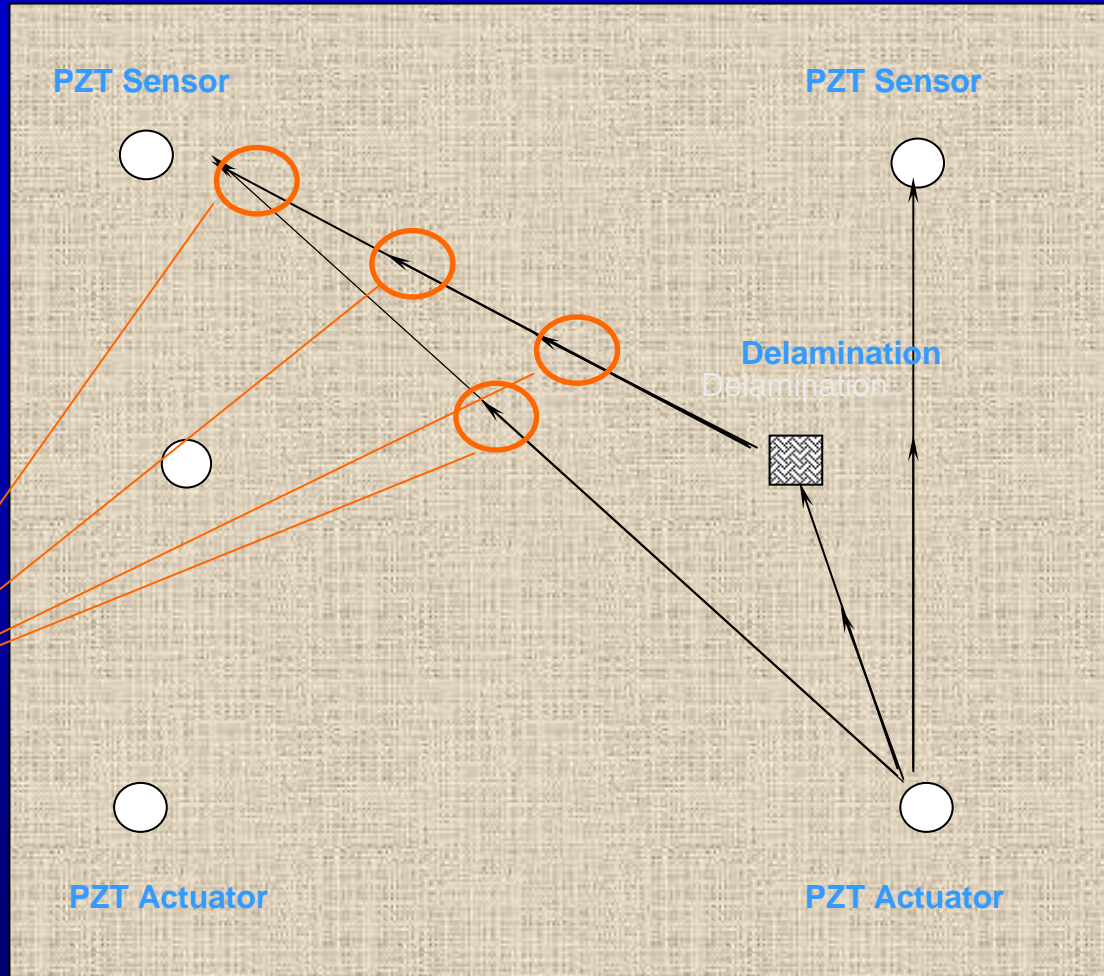
Application Fields

Aerospace
Aeronautical
Maritime
Mechanical
Civil





**Multi-Lamb
Modes**

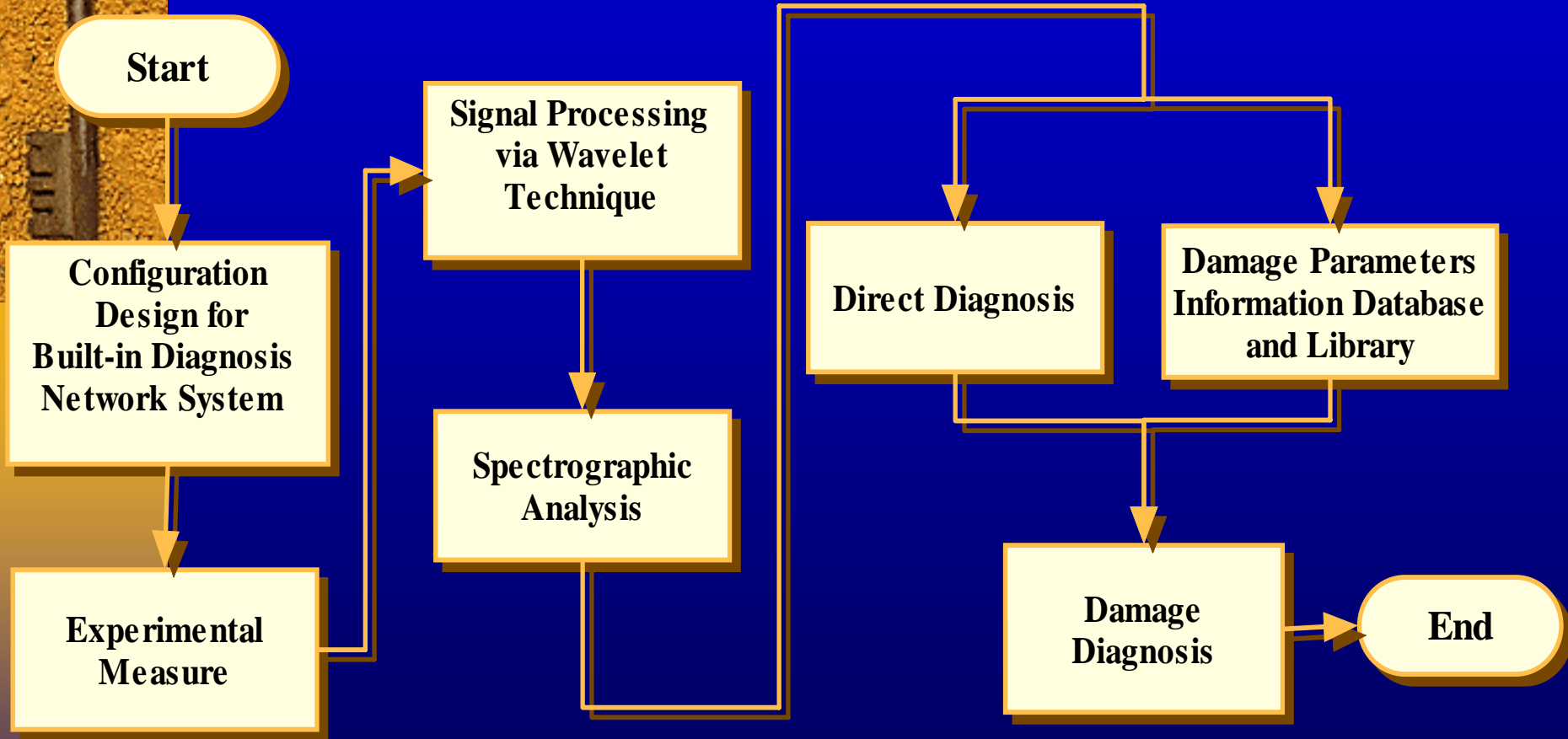


Basic Principle

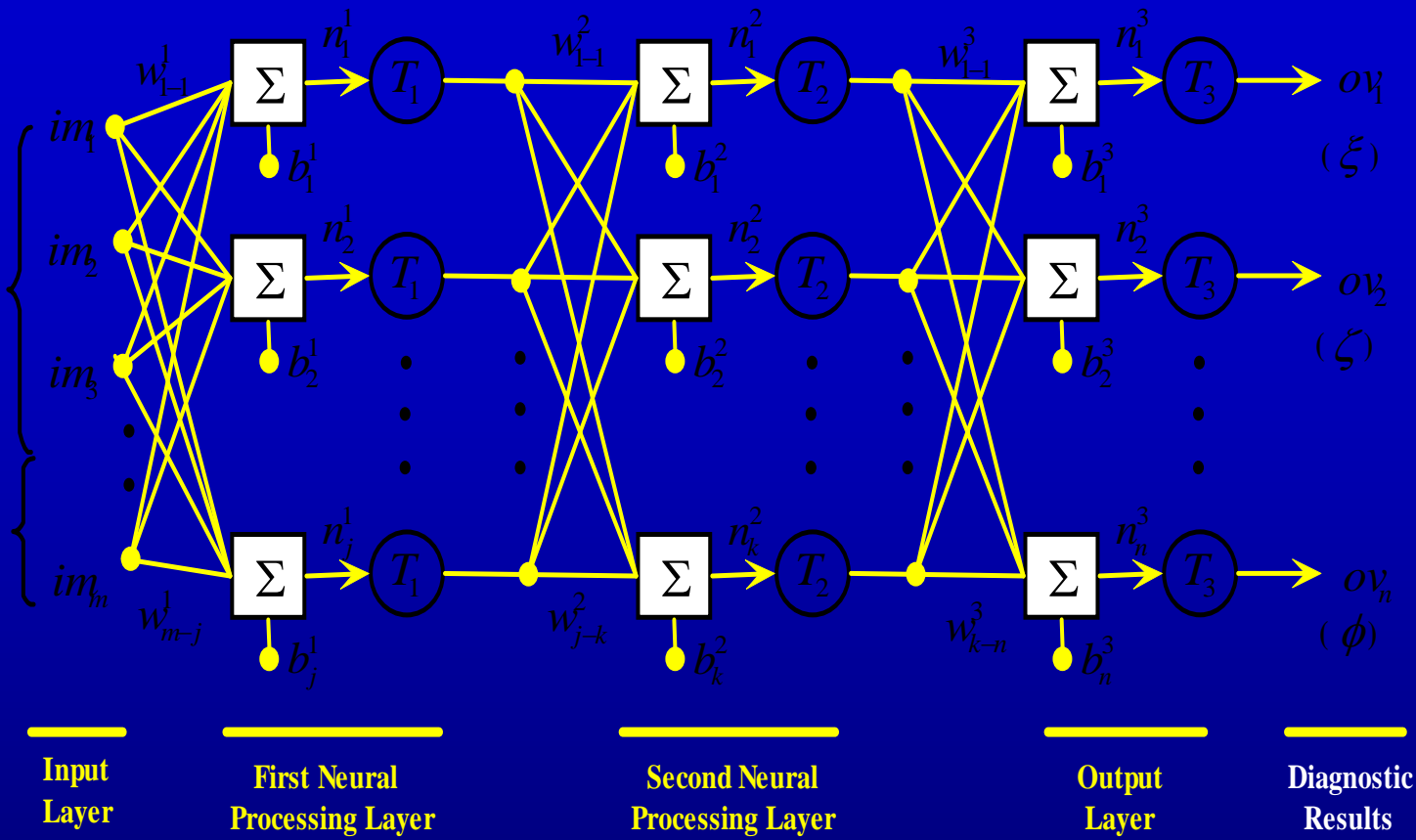
(Lamb Wave Propagation-Based Identification)



Proposed Damage Identification Scheme



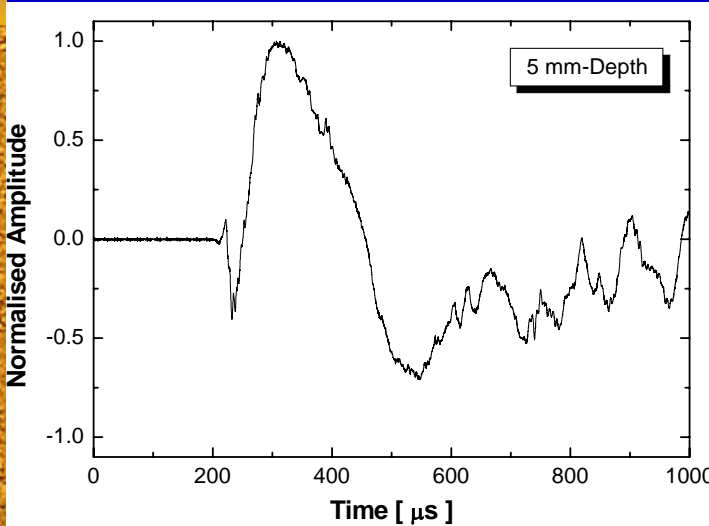
Characteristics of Signals



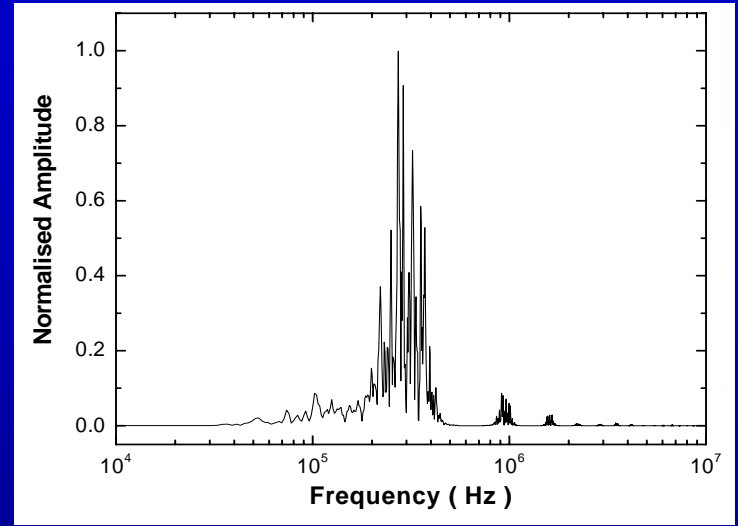
Artificial Neural Network Technique

– A Simulation of Human Brain

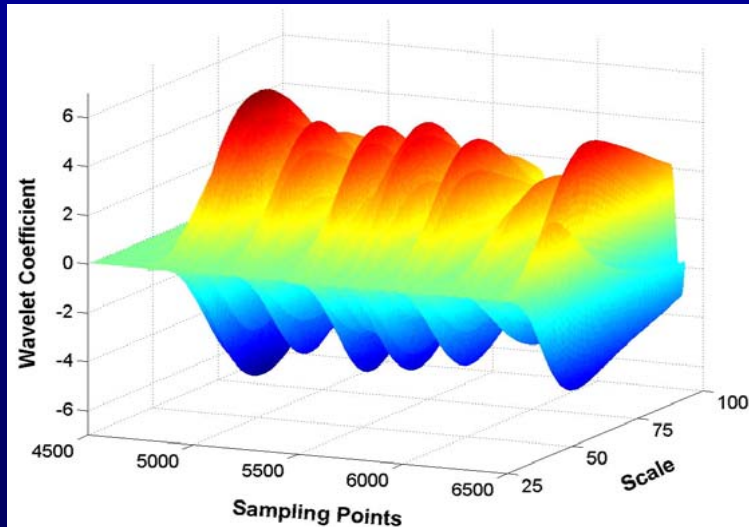




FFT

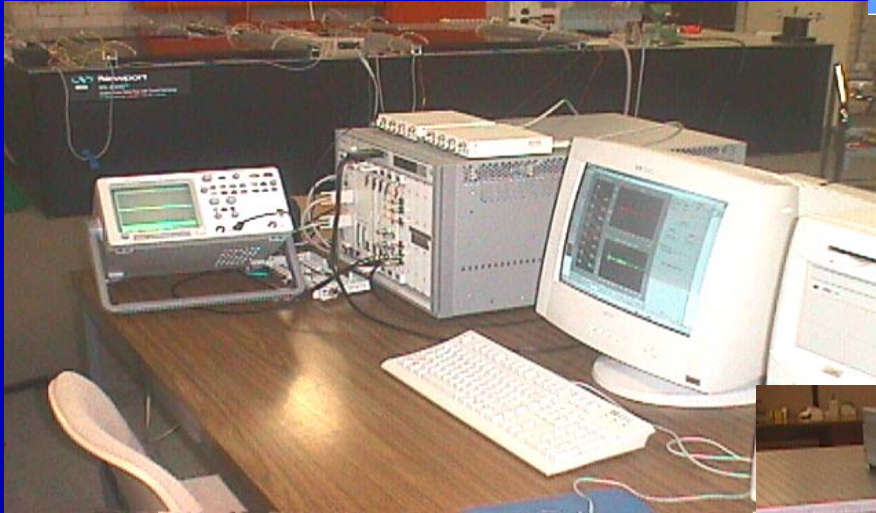


Wavelet Transform

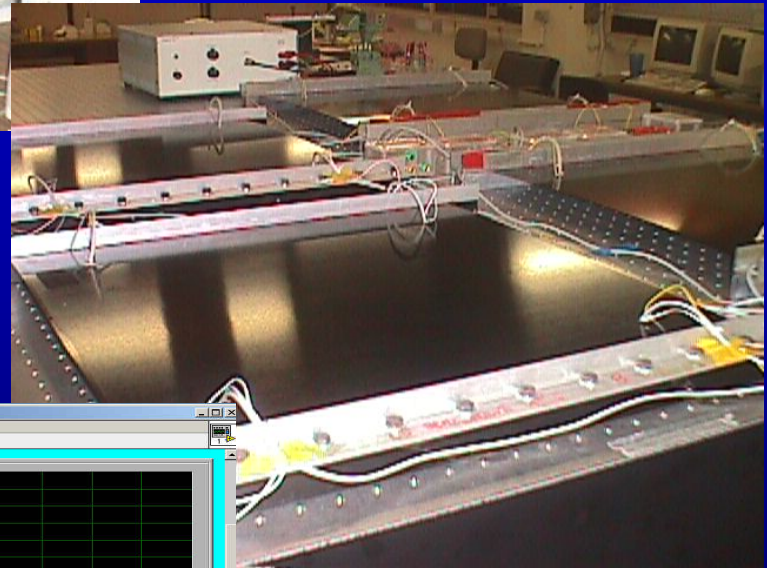


**Signal Identification
(Wavelet Algorithm)**

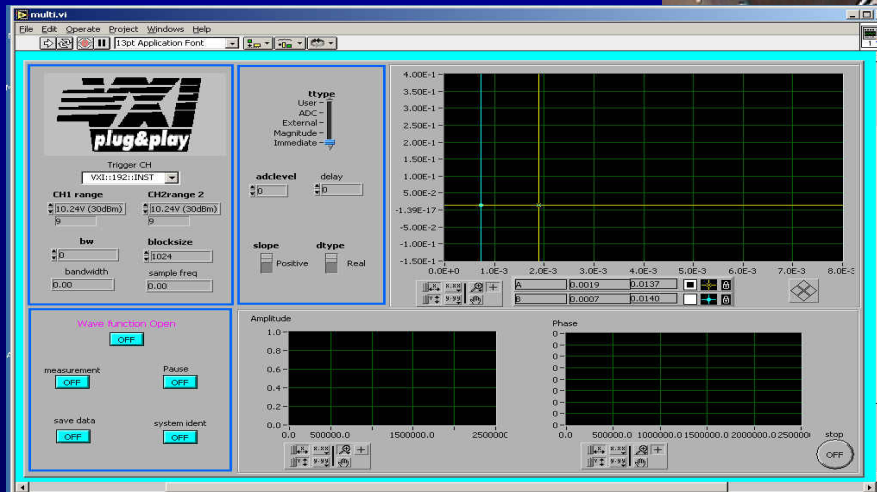




Specimen
(Composite Laminate)

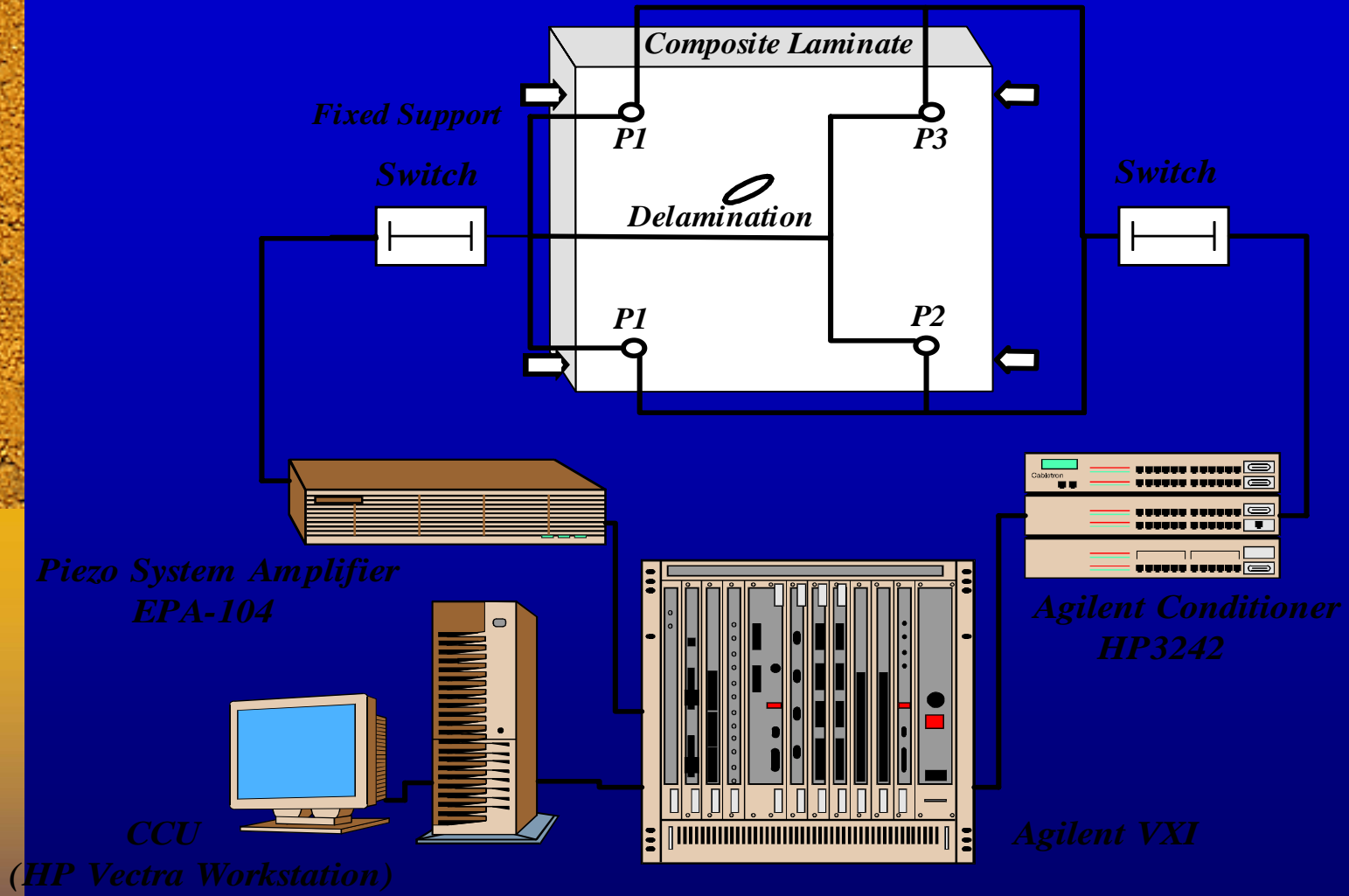


Main Control System



Software interface





Active Online Damage Diagnosis System (VXI Platform)

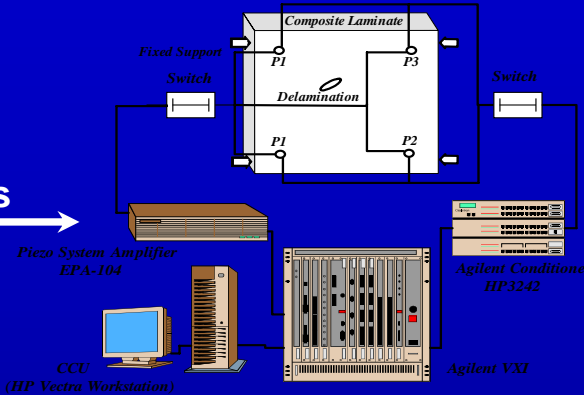


Actual Example

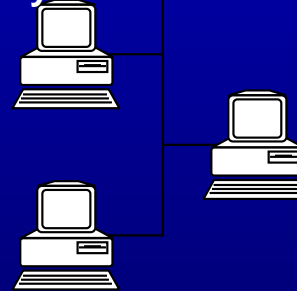


In-Service Aircraft

Bonded
Piezoelectrics

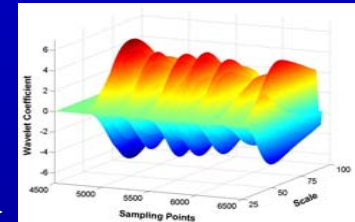


Active Diagnosis
System

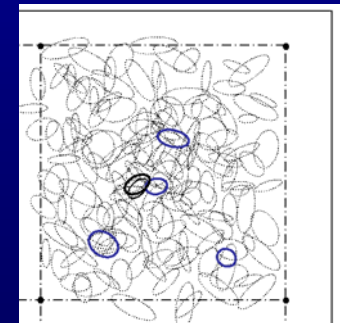


Damage parameters
database

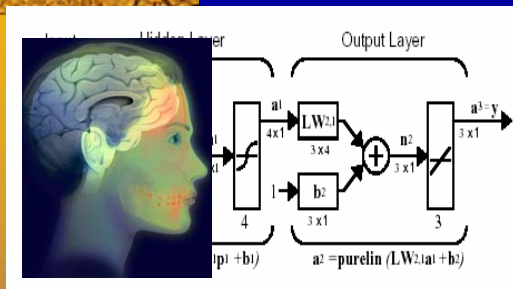
Self-
Rehabilitation



Identification



Failure Diagnosis



Artificial Neural
Network



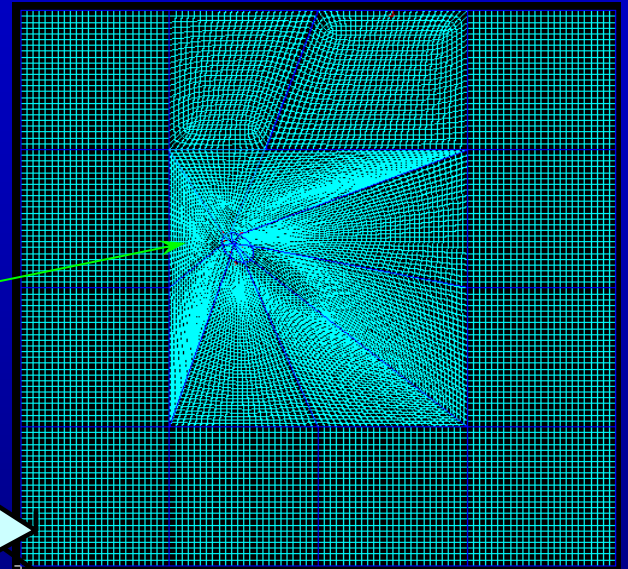
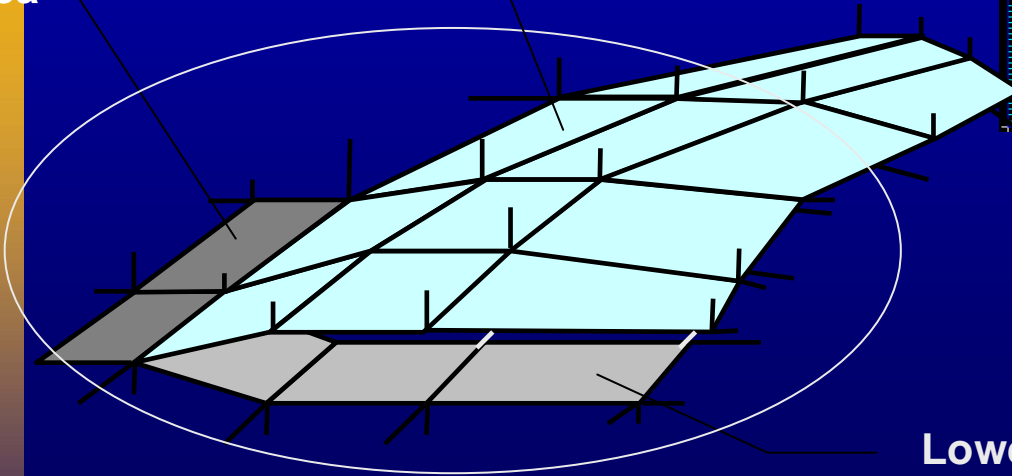
Case Study (1)

(Delamination Detection in Composites)



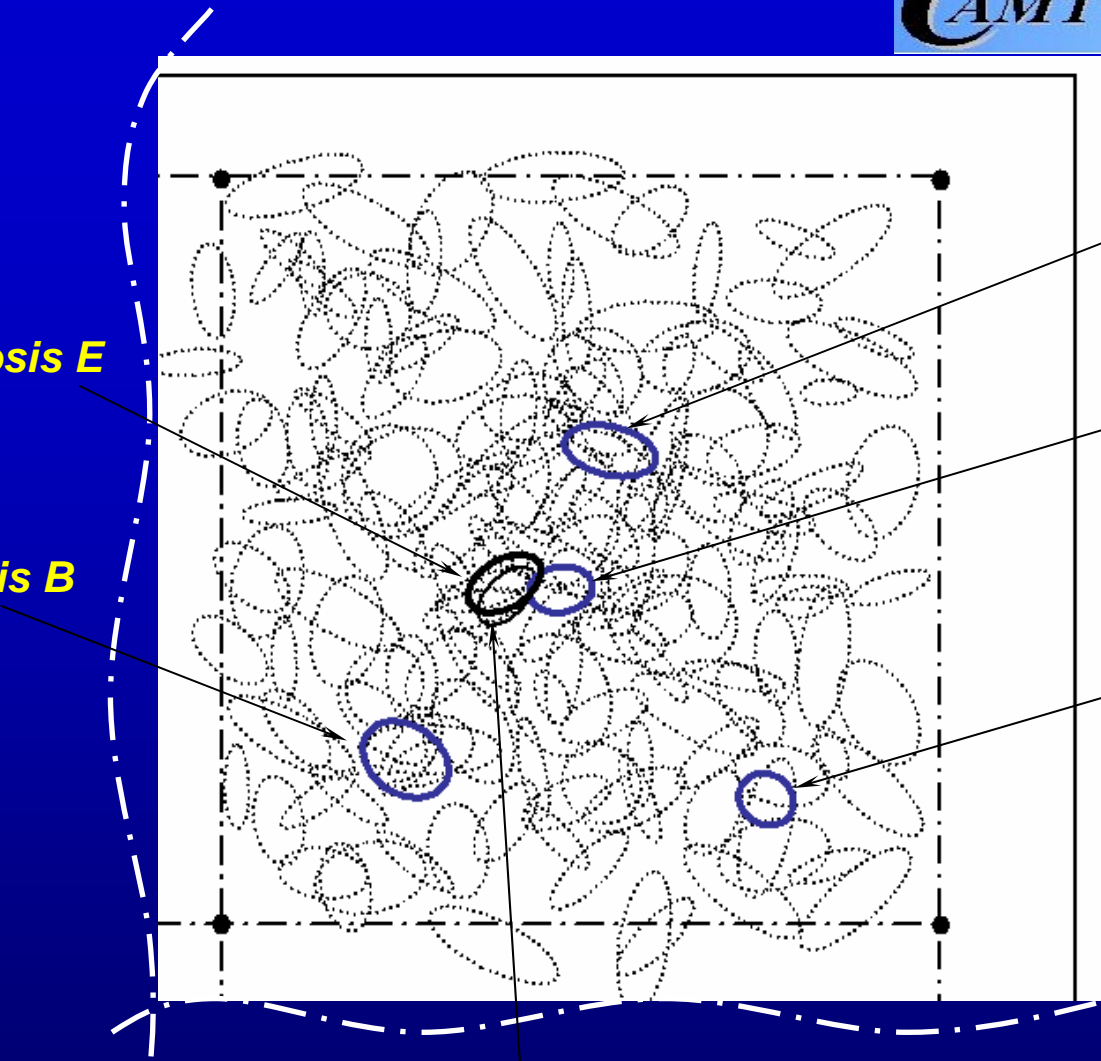
Upper Delaminated Surface

Neighboring Area



Lower Delaminated Surface





Diagnosis E

Diagnosis B

Diagnosis C

Diagnosis D

Diagnosis A

Damage Patterns for Network Training

Actual Damage

Diagnosis A/B/C/D/E: Identification using 20/30/40/60/80 damage patterns for sub-database training

Case Study (2)

(Hole Detection in Composites)

