PhD Proposal 2017

School: Ecole Centrale de Lyon	
Laboratory: ICJ-UMR 5208 CNRS/ECL	**Web site: http://math.univ-lyon1.fr/**
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Collaboration with other partner during this PhD: **In France:**	 **In China:**

Title: Health monitoring of structures
Scientific field: Computer Science, Mathematics, Physics
Key words: Health analysis, Health monitoring, Structure

Details for the subject:

Background, Context:

Health monitoring of structures is a key issue for their integrity and reliability. The problem is exacerbated with the use of composites in many cases highly anisotropic heterogeneous structures that meet often conflicting design constraints. Failure modes and damage to composites are various mechanisms and their associated primers and various projections.

Objectives:

This work is a special issue of the health monitoring of composite materials. More precisely, the idea is to develop an automated methodology evolution of defects. This methodology will couple the mechanical aspects and treatment of data and images. Kinetics may be coupled to the mechanical modeling approaches and treatment adopted by resolution of the problem.

In terms of digital imaging, three research areas will be emphasized:
1- The multispectral image acquisition,

2- Modeling in inverse problems will be used for super-resolution images of deformable surface.

3- Statistical models, particularly through the use of CCA (Canonical Correlation Analysis) will be used to correlate the image data and indicators. These models will eventually be coupled with parametric models in classification and pattern recognition.

Research subject:

The estimating method of defects currently used is based on the image taken by microscopy or micrograph and their manual analysis. This obviously takes a lot of work that could be flawed. Because of these limitations, we are moving towards automating the analysis tool. This transition requires the implementation of elaborated methods of treatment and image analysis.

The recommended approach is to rely on a case-based reasoning (CBR Case Based Reasoning). At first, this is to make the acquisition of data, which are the field measurements (inputs of the inverse problem). At this first stage, the key issues addressed concern the type of sensors: imaging, laser velocimetry, thermography, etc.; their representation: continuous or discrete data; and their modality: surface or volume. These issues will be given special treatment with respect to the issues of the subject.

The acquired data should be representative of the physical phenomena involved (damage, fatigue). They should be represented in a suitable space. These data are then analyzed to provide the relevant classes correlated with the identified statements. Variability's loads, frequency, temperature etc. Tools of statistical analysis will be used at this stage to optimize this performance but also to establish effective metrics that maximize inter-class distance while minimizing inter-class variations.

Finally, the problem of detection or localization and analysis reduces to a case of recognition of forms guided by the data (data driven). A new sample of data is acquired automatically classified through a given metrics and established an automatic classifier. Appropriate techniques for pre-processing, segmentation and classification are studying to improve the quality, resolution and classification.

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