Smart structure maintenance strategies based on Structural Health Monitoring damage indicators

Ganguli Ranjan (Department of Aerospace Engineering, Indian Institute of Science, Bangalore) and Bes Christian (University Paul Sabatier–Toulouse III - Institut Clément Ader E.A. 814)

Over the last decade, the use of structural health monitoring (SHM) systems has been widely investigated in an effort to improve the efficiency of damage detection by giving a real-time status of the health of a structure. Our project focuses on optimizing condition based maintenances under structure safety and costeffective lifetime constraints. This topic involves many research aspects: damage diagnosis methods, fatigue damage propagation models, quantifications of the uncertainties due to SHM measurements, modeling and physical variability using Bayesian state-parameter estimation methods. These quantifications allow to determine the statistical lifetime distribution of a structure. The maintenance intervals can therefore be calculated improving both safety and cost-efficiency compared to traditional maintenances approaches.
This methodology can be applied and validated to composite materials equipped with piezoelectric actuators.
The objectives of the project are:
- Uncertainty quantification on smart material properties, physical variability, SHM system and measurement errors: Bayesian approach,
- Structure damage model parameter identification using real-time SHM data,
- Determination of the structure lifetime distribution from damage propagation model and uncertainties,
- Optimization of the condition-based maintenances in terms of cost effectiveness and life-safety.

Faculty members: Ranjan Ganguli (IISc, Bangalore), Christian Bes (University Paul Sabatier–Toulouse III), Lea Cot (INSA, Toulouse)