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Public Strategy – Monitoring Research Group

Research focus

The monitoring group is focusing on vibration based monitoring of structures

Subject explanation

The response to any structure in operation is measured and used to extract physical quantities that can be related to the finite element (FE) model. In the beginning of a monitoring process steps is normally taken in order to update the FE model to comply with the properties of the structures in its virginal state. Later the updated FE model and the current changes of the physical parameters are used to identify i) if the structure is still in good health (no significant physical changes) and if this is not the case then ii) identify where in the structure a possible damage is located, iii) quantify the extend of the damage and finally iiii) make an estimation of the implications for the remaining life of the structure. The research foci of the group are: operational modal analysis (OMA), especially automated versions of OMA, expansion of mode shapes to all points in the structure (advanced ODS), updating and damage detection and finally structural health monitoring seen from a risk perspective.

Applications

Given the above mentioned definition of monitoring, there is today little or no applications of monitoring. The reason is simply that monitoring is just another cost added to all the other costs involved in maintaining a structure, and thus, until somebody (hopefully this group) can define a clear gain or profit of monitoring nothing is going to happen. Future applications might be areas of large production structures where material consumptions is dramatically cut and the loss of initial design reliability is exchanged the extra reliability introduced by the monitoring system. Examples of future application are in cases i) where the uncertainty of the loading play a large role for the reliability, thus information about loads and stress from the monitoring system increase reliability, ii) cases where slowly increasing damage due to for instance fatigue influence the reliability and thus information about the changes of the structure can be used to quantify the amount of slowly inceasing damage.

Disciplines

The core disciplines of the group are:

- Experimental dynamics (OMA)
- Theoretical dynamics
- Signal processing
- Numerical mathematics
- Reliability theory

The group is internationally strong in OMA, has been involved in formulation of important methods like the frequency domain decomposition (FDD) method, in founding of the International Operational Modal analysis conference (IOMAC) and has close relations to leading companies in commercial OMA software like Structural Vibration Solutions (SVS) and Brüel and Kjær. The group is working intensively with theoretical dynamics in

order to understand and apply the relation between experimental modes and modes from a finite model. One of important results of the group is the Local Correspondence (LC) principle that allows a simple linear relationship between mode shapes in a model and mode shapes from a test. Also the group has contributed to important results in signal processing especially concerning application of the random decrement technique. Numerical mathematics and reliability theory are core disciplines from an application point of view.