seminario interuniversitario de mecánica y materiales

SEMINARIO INTERUNIVERSITARIO DE MECÁNICA Y MATERIALES

SEMINARIO JOSÉ ANTONIO GARCÍA

MÁSTER DE ESTRUCTURAS

RECENT ADVANCES IN STRUCTURAL HEALTH MONITORING

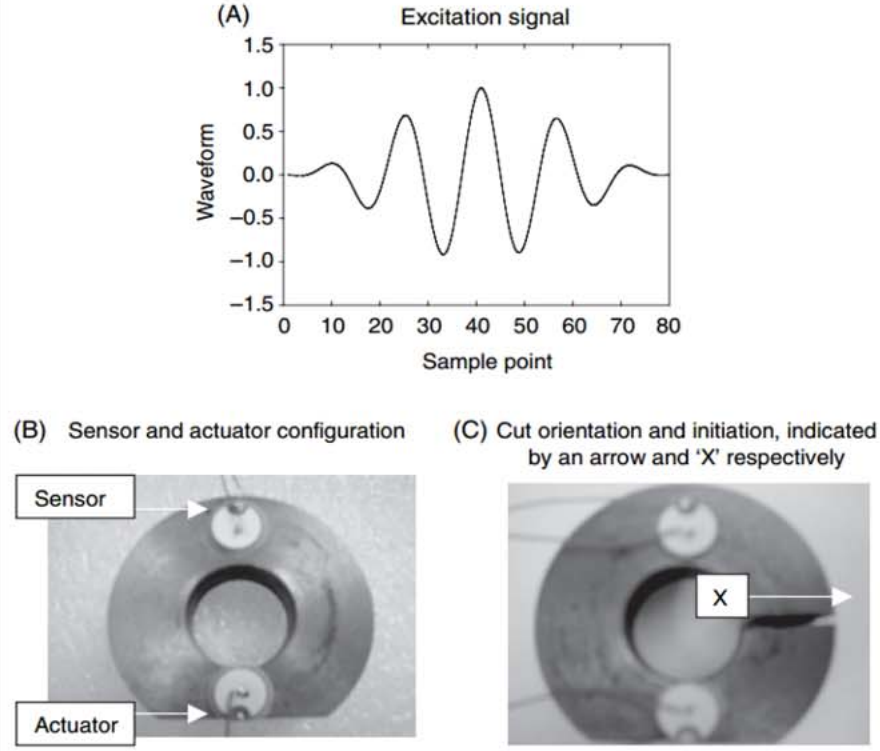

Figure 4: Excitation signal and the specimen conditions

Prof. Keith WORDEN

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University of Sheffield, UK

Día : Miércoles 7 de noviembre 2012
Hora : 11:30h
Lugar : Seminario I, E.T.S. Ing. Caminos, C. y P.
Campus Fuentenueva

Universidad de Granada

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EFFECTS OF UNCERTAINTY IN LARGE NONLINEAR MODELS

Keith WORDEN

Abstact:

The early stages of development of a new engineering structure from design to commissioning can be exceedingly costly. One of the major drivers in this cost is the need for physical prototyping and experimental testing of the prototype to make sure it meets design requirements. It is argued that these costs could be reduced considerably by more emphasis on computer modelling in the early stages of product development – a sort of virtual prototyping.

One of the major problems anticipated in the attempt to replace testing with modelling is that computer models will not generally provide a complete representation of the in-the-field structural behaviour. Assuming that adequate computer resources are available; the main reason for lack of model fidelity will be model uncertainty.

In this context there are two types of uncertainty: aleatory and epistemic. Aleatory uncertainty, sometimes called 'irreducible' uncertainty is associated with the truly random and unknowable features of the operating environment of the structure e.g. the temperature experienced by the structure. Epistemic uncertainty, sometimes called 'reducible' uncertainty is associated with incomplete knowledge of the structure; information which could in principle be learned by future experimentation.

If predictions are to be made on the basis of a model of a structure or system, it is critical to take account of aleatory uncertainty in order to encompass the full range of possible behaviours under random conditions. It is also important to assess the contribution of uncertain model parameters to the overall response uncertainty; in this way future experimentation can be directed towards learning more about the uncertain parameters which contribute most to uncertainty in the predictions.

These two problems can be accommodated respectively by uncertainty propagation and sensitivity analysis.

In this seminar will be discussed how the required analysis can be carried-out; particularly in relation to a principled Bayesian framework. The discussion is illustrated through the use of a number of case studies including a human heart valve model and an airship model.

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