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Quality Assurance in Finite Element Analysis

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Summary

This is an introductory talk at the start of the session outlining questions to be discussed during the plenary session.



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At the Trieste meeting the consensus was that for a business critical analysis the most important requirement was for a good Quality Assurance system to be in place.

Various industrialists have since provided the co-ordinator with copies of their QA systems. These have been provided on a 'semi-confidential' basis and so they will not be generally released

NAFEMS Quality Assurance Procedures for Engineering Analysis, which was published in 1999, should be noted.



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The achievement of quality necessitates the satisfaction of three principal aims:

- a clear definition of what is to be achieved
- a description of the activities and functions that need to be performed
- the control and monitoring of the performance of those activities and functions.



It also states that the *candidate's training records* are reviewed to ensure that the candidate:

- is qualified to first degree (or equivalent) standard in engineering, physics, computing or a mathematically based science, or by professional qualification and standing which is recognised by the relevant professional bodies as equivalent
- has completed a formal training course in the use of the analysis system, or has appropriate experience in lieu of formal training
- if involved in analysis that requires special skills or knowledge (e.g. structural dynamics), has completed a formal training course in that discipline or has direct access to another suitably qualified member of staff for consultation
- has completed a formal training course in the application of these quality procedures and has read and understood the Quality Manual.



There are potential problems associated with the ability of the staff. For example:

- Someone may attend a training course but have they understood? Normally there is no exam associated with a training course.
- Does an analyst understand the behaviour of a body? As an example, attention is drawn to the article by Bob Johnson in Benchmark April 2001 (p2) and the answer in July 2001 (pp 40-41). These discuss the problem of fully understanding how a body behaves. How is this taught? Another example where a mode of failure was not appreciated is the Millennium Bridge in London.
- A typical British undergraduate course will hardly cover anything other than the basics of what a finite element package can deal with. (This is probably also true for other European undergraduate courses.) How does an analyst gain the necessary experience? How can we be sure an analyst has the necessary experience and how can it be measured?



- Another way of undertaking safety critical analyses is that of the US Nuclear Regulatory Commission. In this case two independent analyses are performed using two different codes. Does this imply that for a greater degree of confidence that this procedure should be followed for analyses which do not have any other validation such as experimental work?



Topics for discussion in Barcelona

- Should short courses have tests associated with them?
- How does an analyst gain an understanding of how structures behave?
- Should FENET/NAFEMS be developing checklists for different types of analysis?
- Should NAFEMS Registered Analyst scheme be modified? If so, how?
- Is a QA system sufficient for a business critical analysis?
- How can a Suitably Qualified and Experienced Person (SQEP) be defined?
- Some of the schemes provided contained automatic/defined report writing. Is this satisfactory?
- Should NAFEMS resurrect the QA Working Group? Could this be a virtual WG to encompass the total membership?
- How can best practice be shared?



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