Education of Engineers in Design Improvement Methods.

R. Adams², J. A. Tomas¹

¹ School of Aeronautical, Mechanical and Material Engineering, RMIT University, Melbourne, Australia
²Advea Engineering, Melbourne, Australia

ABSTRACT

The history of objects, as invented and produced by man, is the history of incremental design improvements, aiming, for example, at lighter, yet more durable components, or at creating less noisy structures, or even structures that resonate at a pleasant tone.

Even today, when powerful computational methods are available for structural analysis, the usual procedure for design improvement is still based upon the results from the analysis, with the decision about design changes being left to analysts and designers, based on their knowledge, experience, and, more often than not, on their "engineering feel".

The course in design improvement at RMIT Melbourne aims at training students in modern design improvement methods and to teach them practical skills for selecting the method appropriate for a given task. The course is offered in the sixth semester, after the students were introduced into linear FEM in semester five.

The theoretical background of selected mathematical methods of optimization is reviewed first. Then the concept of design sensitivity is introduced and demonstrated on truss and beam structures. Finally, the problem of "reconciling" the discreteness of finite-element meshes with the smoothness of CAD designs is presented and solution methods exercised.

The software ReSHAPE, which has implemented most of the available methods for design improvement, is used, together with pre- and post-processors ANSA, HyperMesh and Patran. Each lesson is accompanied with solved examples and tutorial problems. Students are required to validate the solution of each problem by any alternative method available to them. At the end of the course, students solve one practical problem of their own choice, to demonstrate the level of their competence.

With this initiative, the industry will be provided with structural engineers, who are at the fore-front of the application of finite-element methods and who will be able to contribute more effectively to designing better products.

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