NAFEMS Benchmark Challenge

30 years ago NAFEMS started life as the National Agency for Finite Element Methods and Standards. One of the organisation's initial aims was to design a series of benchmarks that could be used to determine the accuracy of an analysis code. Guidelines on what makes a suitable benchmark can be found in many of our early publications. One of the guiding principles behind the benchmarks that readers may not be aware of is that:

> "The benchmark should have some educational merit"
>
> A.A. Becker, Background to Material Non-Linear Benchmarks.

Education and best practise are still at the heart of NAFEMS activities and it is with this spirit and a hint of fun that we would like to introduce the Benchmark Challenge Problem series and Angus Ramsay, who will be acting as Independent Technical Editor. Angus will be posing a series of challenge problems that will be hosted on our website at www.nafems.org/challenge
You can view the first in the series there now -

We recommend that readers check the challenge problem website regularly, as Angus will be posting hints and tips relating to the challenge problem.

NAFEMS invite readers to send their responses to challenge@nafems.org. The reader providing the highest number of correct answers to the series of problems will be entered into draw to win an iPad mini in October 2015.

Good luck!

Stress at the Centre of a Square Plate with Linear Boundary Tractions

A unit square homogeneous and isotropic steel plate is centred at the origin of the XY-plane with edges parallel with the coordinate axes and is loaded with linearly distributed normal and tangential boundary tractions as shown in figure 1. The plate can be assumed to be thin so that a plane-stress constitutive relationship is appropriate and for convenience a unit thickness may be used.

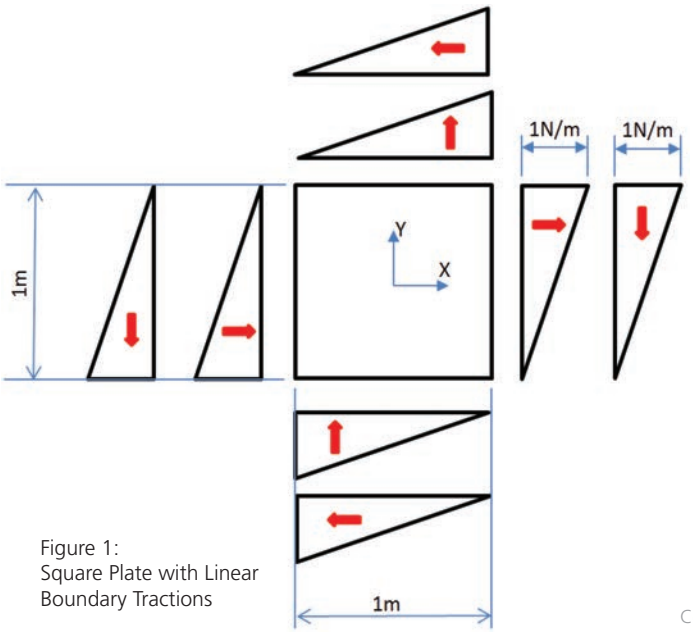

Figure 1:
Square Plate with Linear Boundary Tractions

The Challenge

The challenge is to produce **two models** of this problem in your finite element software and then answer some questions. The first model should use a **single four-noded element** and the second a **single eight-noded element**. As engineers interested in the integrity of the plate we might wish to see the distribution of von Mises stress over the plate. We would like you to provide:

a) Numerical values for the von Mises stress at the centre of the plate for both models,

b) A statement as to which of these values is correct,

c) Contour plots of von Mises Stress for both models,

d) A brief commentary on how you modelled the problem and what, if anything, of interest you note about this problem – please include details of the software that you used.