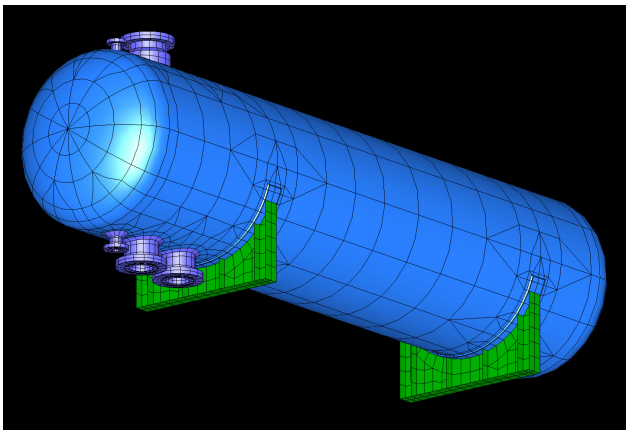
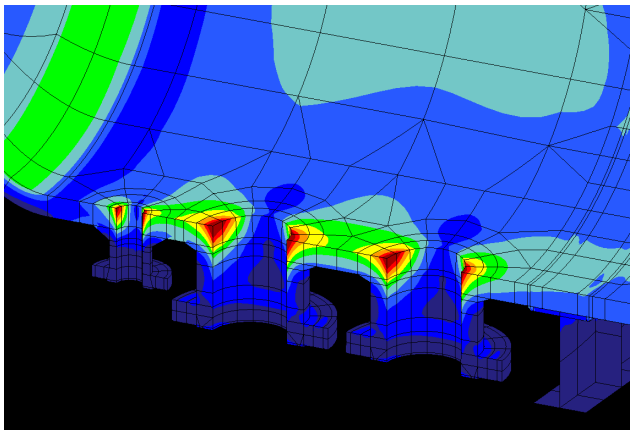
PRODUCED WATER SEPARATOR
STRUCTURAL INTEGRITY ASSESSMENT

All major national and European standards covering the design and construction of pressure vessels permit the use of design-by-analysis methods to demonstrate Code compliance. These methods are commonly used to assist with the design of particular features which infringe geometric limitations governing the available Code rules. Design-by-analysis is also occasionally used to establish acceptability at a late stage when manufacturing faults are discovered during third-party inspection. Rapid advancements in computer hardware and software capabilities over the past ten years or so has increased the use of finite element methods to the extent that it is now the main tool used to tackle problems requiring the use of design-by-analysis. However, with the continued widespread use of shell rather than solid elements for such analyses, there remains a puzzling reluctance to take full advantage of the hardware and software technologies now available.

One example of FCL's work in this area is the design substantiation of a Produced Water Separator vessel for a major offshore operator. The work was found to be necessary after some deficiencies were noted in the documentation put forward in support of the design of the vessel. The specific problem related to a number of process nozzles grouped closely together at the bottom of the vessel close to one end of the shell which, on review of the supporting design calculations, were found to be provided with insufficient combined reinforcement under pressure and externally applied piping loads.





After attempts to substantiate the nozzle designs using design strengths based on actual material properties, FCL developed a three-dimensional solid finite element model of the vessel with a view to proving the design using design-by-analysis methods. The use of solid, rather than shell, elements enabled the structure to be faithfully represented so that credit could be taken for local increases in thickness offered by weld cappings at the nozzle/shell junctions. This, together with use of actual wall thicknesses, enabled FCL to demonstrate the fitness-for-purpose of the vessel to the satisfaction of the certifying authority. The use of a solid element model was vindicated some time after completion of the work when FCL were advised of the misleading results of independently commissioned shell element analysis which showed that substantial design margins were available.

Finglow

FINGLOW CONSULTANTS LTD
Beane Bridge House, 34 Chambers Street, Hertford, SG14 1PL, UK
Telephone: +44 (0)1992 585450
Facsimile: +44 (0)1992 585460
e-mail: enquiries@finglowconsultants.co.uk
website: www.finglowconsultants.co.uk