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CAD User

MECHANICAL DESIGN COMPUTING

Socket to me!
Picking up the thread with IDAC

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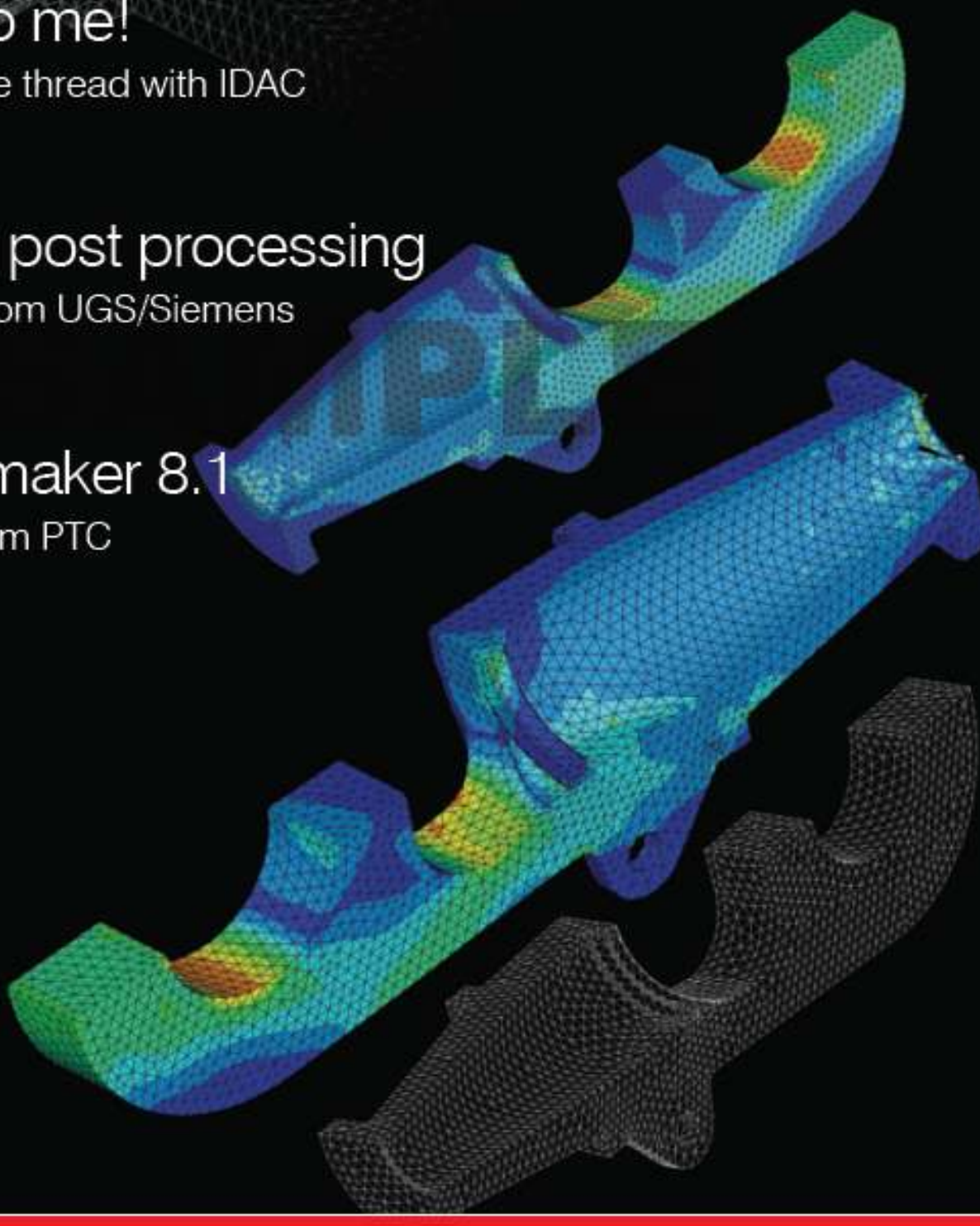

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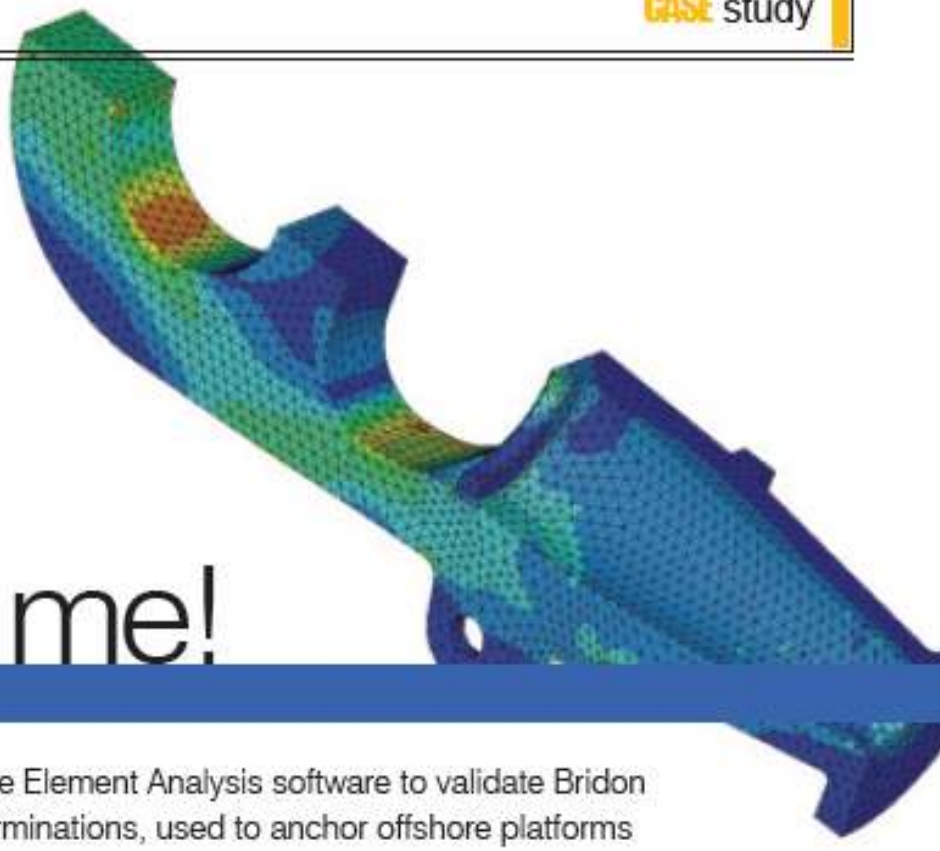


Socket to me!

IDAC uses Ansys/Mechanical 6.0 Finite Element Analysis software to validate Bridon International's design for steel rope terminations, used to anchor offshore platforms

Bridon International (www.bridon.com) is part of FKI plc, an international engineering group. Bridon Group is a world leader in the manufacture of specialised wire and high performance wire rope products and a global distributor of lifting systems for the industrial, mining, energy, construction, marine and fishing markets.

Bridon's Doncaster operation required a structural contact analysis of some steel rope terminations for anchoring offshore platforms before casting could take place. IDAC was engaged to perform the solid modelling and non-linear structural analysis of the designs

SCOPE OF PROJECT

The rope terminations are used in anchoring offshore oil platforms. Although similar designs are already used extensively in industry and have a proven ability to take operating loads, Bridon's clients required a validation analysis before accepting delivery. Bridon also held detailed hand calculations for all models; nevertheless, analysis was needed to validate these, as well as performance in the field having been proven.

"IDAC was recommended to Bridon by a supplier who could not commit to the fast-track time limits set by our customer for this project." explains Stuart Hallam, Technical Manager - Cable Products at Bridon International. "IDAC's quick and knowledgeable response to the initial enquiry gave Bridon the confidence to place an order for the finite element analysis."

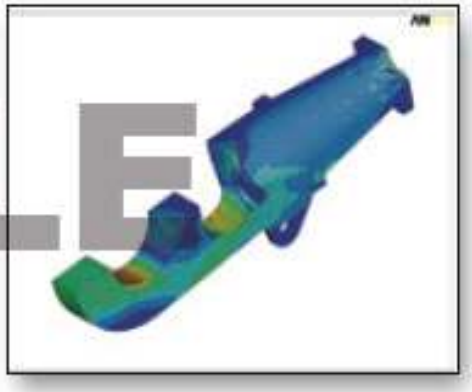
The rope ends are single castings of over a metre in length, the largest of which weighs well over a tonne. The steel cable is inserted into the cavity of the casting, and then fixed in place with a setting resin to prevent it sliding out. With the socket fixed through a pinhole, it should be able to withstand cable loads of up to 5000 kN in the case of the largest socket.

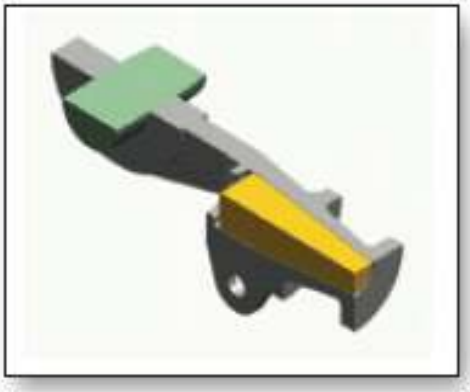
Such large-scale components are obviously not suited to easy prototyping. The nature of offshore work also demands safely designed parts, so accurate computer simulation offers a cost and time effective tool for the design process.

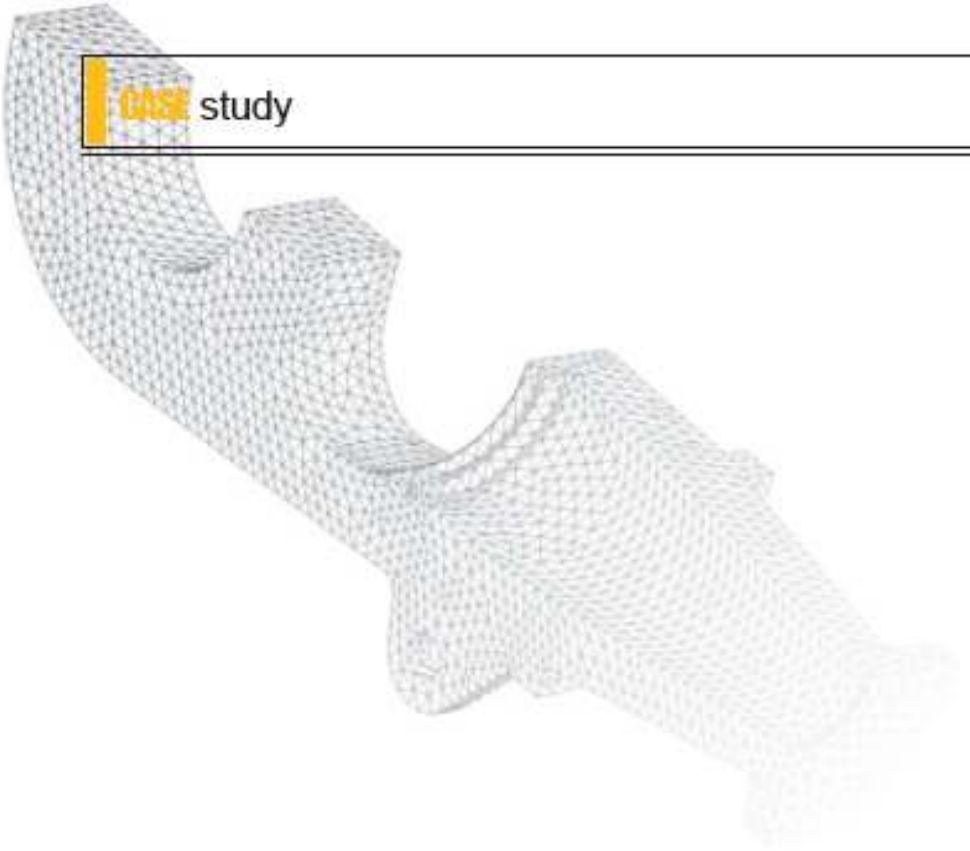
SIMULATION DETAILS

Bridon supplied 2D drawings of the three rope terminations, so that IDAC could create solid CAD models of the cast sockets and associated parts. These were imported straight into ANSYS/Mechanical 6.0 for the Finite Element Analysis (FEA) stage

The model included non-linear material properties for the steel parts to cater for any localised yielding that might be







experienced. The resin, in which the steel rope was set inside, had directional material properties. IDAC modelled this behaviour in ANSYS with no problems.

The resin used in the sockets shrinks by up to 2% when it sets, therefore a significant amount of movement is possible before the resin plug experiences any load. ANSYS' contact capabilities cater for large displacements such as this and also provides high-order surface contact elements that can represent complex surfaces such as the resin plug.

Load scenarios were run to predict the structural response at stages up to and including the breaking load of the cable. Separate load cases were also run for the different loads experienced during installation.

Results indicated that the "closed" style socket would withstand maximum loads without exceeding material stress limits. The two "open" style sockets however, could experience highly localised yielding as the breaking load of the cable was reached. The non-linear material analysis predicted that plasticity redistributed stresses and yielding did not continue through the section therefore part failure would not occur.

This behaviour suggested that through experience and previous calculations, Bridon had arrived at an optimal design with respect to material use. The sockets could safely endure the design loads whilst not using excess material in doing so. The FEA results confirmed this, and furthermore provided valuable information in areas where it was difficult for hand calculations to represent all possible stresses.

BENEFITS

Whilst Bridon needed validation of the rope terminations for their client, the resulting analysis additionally provided information that would have been expensive and time-consuming to gain from prototype testing. The analysis acted as a valuable confirmation of their hand calculations, and also provided further insights into behaviour such as stress distributions after yielding. With the results of the analysis, Bridon could proceed to the casting stage with increased confidence in their sockets and internal design procedures.

"The final report, being presented two weeks from instigation of the work, was professionally presented and enabled Bridon to issue it direct to our customer with the addition of a very simple preface," adds Hallam. "This report has now been fully accepted by both our customer and third party checking agency, allowing casting of the components to commence within the time frame set by the project team."

www.idac.co.uk