

NAMTEC adds WELD PLANNER to its suite of simulation software for rapid analysis of welded assemblies



Rolls-Royce

THE CHALLENGE

To evaluate the welding distortion of a large, electron beam welded assembly made from a Ni-based superalloy and provide recommendations for the welding sequence and clamping positions that would result in the least distortion.

To solve a complex model in a short timescale whilst maintaining a suitable level of accuracy, providing timely and insightful results to the customer.

THE STORY

NAMTEC's investigation with Weld Planner of the global distortion of a specific complex case led to recommendations for clamping positions, weld positions, welding sequence, and even for the development of the component designs.

THE BENEFITS

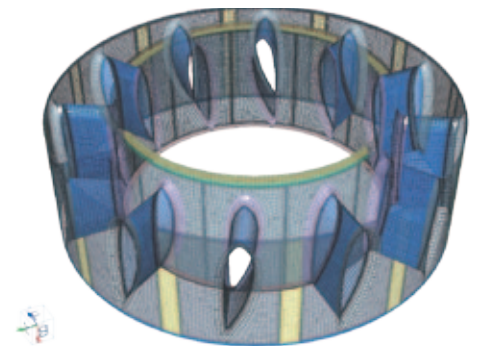
"Weld Planner has been used at the National Metals Technology Centre (Namtec) for modeling welding deformation of large and complex assemblies. We have found that the software is very fast and straightforward to achieve rapid results, even for large mesh densities with a high number of welds. A key attraction of this software is that the representation of the material is simplified as the analysis is based on shrinkage techniques only; no temperature-dependant material data or phase transformation data are required. The intuitive graphical interface has enabled us to define weld lines and clamps easily. The 'process definition' tool has been used to explore a range of weld sequences and clamping configurations rapidly, and therefore Weld Planner is ideal for investigating a high number of iterations of weld sequences at an early stage of the design process."

Dr. Kathryn Jackson,
Technologist, NAMTEC.

The economic incentive for using welding simulation at an early stage of the design process is to evaluate design and process choices before engineering teams freeze their designs for production. As a direct result, this reduces development costs and risk of unwanted rework or scrapped assemblies due to unacceptable dimensional quality issues.

The National Metals Technology Centre (NAMTEC) employs a wide range of simulation software to which ESI's Weld Planner has been added. This widens the range of advanced engineering services the Centre is able to offer to industrials. Weld Planner is used in conjunction with Visual-Mesh to generate the meshes for Weld Planner finite element models, and Visual-Viewer for post-processing of the results.

The primary benefit of using ESI's Weld Planner for distortion studies is that it can deliver considerable time savings over equivalent transient welding simulations. The mesh of the case example was a welded assembly that consisted of approximately 55,500 elements with 64 welds and 121 individual clamps. **This case example was solved by ESI's Weld Planner in less than two hours, whereas a transient analysis would have taken several days.** This significant time saving enabled NAMTEC to consider a wider range of welding sequences than would normally have been possible. More importantly, the time saving achieved provided the opportunity to investigate different part designs in addition to weld sequences and clamping methods.



55,500 elements, 64 welds, 121 clamps.
Courtesy of Rolls-Royce

The integrated suite of software provided by ESI has the advantage of enabling models to be setup, exported for simulation and post-processed, completing every stage of the model development process. ESI's Visual Mesh software is used to generate the required shell element mesh from the 3D CAD models or directly by importing an appropriate mesh directly into Weld Planner.

A further benefit of using ESI's Weld Planner is that the welding sequence can be modified easily using the process definition tool. This is ideal for rapidly setting up models with a wide range of welding sequences, enabling a large number of options to be explored.

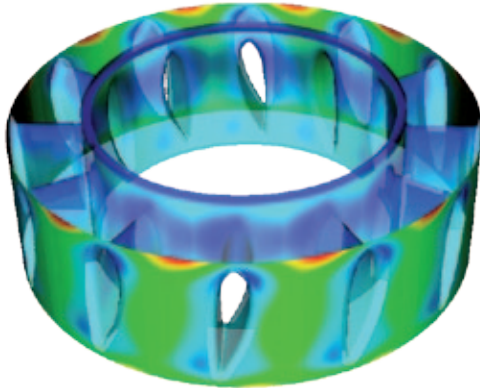
The well-designed GUI makes Weld Planner straightforward to use, further reducing the time required for preparing the models. The intuitive command sequence enables welds and clamps to be easily defined and visualized.

From this investigation NAMTEC was able to recommend clamping positions, positions of welds and welding sequence. On the basis of the Weld Planner results, critical clamping locations at various stages of the welding sequence have been identified from which the most adequate clamping positions were derived. The effect of incorporating features directly into

the original form of the components as an alternative to welding was investigated, leading to further recommendations for the product design and fabrication route.

The competitive advantage brought by ESI's Weld Planner is the ability to explore a wide range of welding scenarios at an early stage

of the design process. The rapid solution time and ease-of-use enable a wider range of options (designs, weld sequences and clamping) to be explored than would be possible using a transient analysis. Weld Planner makes it possible to maintain design flexibility, which results in a higher quality product. The use of distortion results provides an effective and collaborative communication tool for design and manufacturing engineers who receive early insight into the behaviour of the assembly under different manufacturing scenarios.



Deformation results rendered by Visual-Viewer
Courtesy of Rolls-Royce

"Rolls Royce found Weld Planner impressive due to the time taken to perform the analysis, the quality of results produced and the flexibility it offered in the early design cycle. Weld Planner enabled an investigation of the fabrication route to be integrated with the thermo-mechanical design stages of the assembly."

Scott Wood,
CEng MIMechE – Mechanical Engineer - Advanced Engineering,
Transmissions, Structures & Drives, Rolls-Royce

For more information, please visit www.esi-group.com/products/welding

ABOUT NAMTEC

The National Metals Technology Centre (NAMTEC) was established in 2002 as a knowledge transfer organization to provide technical information and advice to metals manufacturing companies across the UK. Based in Rotherham, South Yorkshire, NAMTEC supports the UK metals industry through a range of services including consultancy, technology and knowledge transfer, training and membership services. NAMTEC's Design, Modelling and Simulation (DMS) Centre was founded in 2006 to deliver modelling and simulation services to the Advanced Engineering and Materials (AEM) sector. NAMTEC's DMS Centre has a team of highly experienced engineers with many years of modelling and simulation experience in engineering and manufacturing. A range of core services are provided including independent engineering consultancy services, software specific simulation training, and research and development. NAMTEC's DMS Centre has access to an extensive portfolio of simulation software and has the capability to support a diverse range of industry sectors including: aerospace; automotive; oil and gas; defence; power generation; biomedical; and metals processing.

ABOUT ESI GROUP

ESI is a world-leading supplier and pioneer of digital simulation software for prototyping and manufacturing processes that take into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on product performance. ESI's products represent a unique collaborative and open environment for Simulation-Based Design, enabling virtual prototypes to be improved in a continuous and collaborative manner while eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.



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