



PAULIN RESEARCH GROUP

FEATOOLS™ FOR CAESAR II®

Capabilities:

- Apply more applicable SIF and Flexibility Factor Data
- Incorporate Code updates in B31J 2017 and Appendix D
- Improve accuracy of designs and analyses
- Improve analyses of components in cyclic service
- Produce more cost-effective designs
- Reduce design changes and iterations
- Calculate more realistic allowable loads on nozzles
- Analyze components outside of code limits
- No FEA experienced needed equipment

FEATools™ improves the quality of CAESAR II users' analysis for critical service lines by incorporating finite element analysis (FEA) and other empirical sources into the evaluation process. Automatically include coverage of the B31J 2017 ASME B31 Code update in your analysis and generate more accurate SIF and Flexibility Factors for relevant components. By using CAESAR II in combination with FEATools, analyzed systems are neither over- nor under-designed, but designed with consistent safety factors, which also saves time and money.

Higher Accuracy, Lower Costs

Piping analysts know that properly qualified FEA presents the greatest opportunity to produce the most accurate analysis results. However, FEA can be extremely time-intensive and require more technical expertise than is needed for the majority of pipe stress problems. An ideal solution would allow FEA results to be easily and seamlessly incorporated within traditional code-based pipe stress analysis, so that your jobs benefit from the accuracy of FEA and the practicality of code-based analysis. CAESAR II with FEATools provides this solution.

Addressing Code Limitations

There are well-known limitations in piping code accuracy when it comes to piping branch connections. Performing a complete FEA of a piping system can be prohibitively expensive. Instead, using FEA data for branch intersections is one of the most effective and pragmatic uses of FEA technology for code-based pipe stress analysis.

FEA Results and Piping Codes

Piping codes such as ASME B31.3 Appendix D state that, in the absence of more directly applicable data, the engineer should use the stress intensification factor (SIF) and flexibility factor (k factor) data from Appendix D of the code. FEATools uses the results of the latest analysis, research, and testing to supply this “applicable data” to CAESAR II, and it does so seamlessly and intuitively.

Nozzles

FEATools also provides a quick way of calculating nozzle stiffness, allowable loads, and stresses due to user-defined load sets. This more accurate nozzle flexibility reduces stress in the piping system during thermal load cases. This improves on the accuracy of older methods used in the industry for qualifying nozzle loads such as WRC 107 and WRC 297. It addresses nozzles on heads and shells as well as radial, hillside, and lateral nozzles.

When to Use

Accurate SIFs and k factors enable pipe stress analysts to use the built-in flexibility of a piping system to reduce unnecessary redesigns of the system, which often have design constraints or piping code limits. This reduces interdepartmental iterations in the design process and saves valuable time and money. FEA-derived SIFs and k factors are typically recommended in the following piping configurations:

- Systems with large diameter thin-walled pipe ($D/T > 50$)
- Systems that connect to sensitive or rotating equipment
- Systems with operating cycles anticipated to be more than 5000
- Systems with short or stiff piping (where k factors have large impact)
- Systems that require more accurate spring hanger design
- Systems that use thin-walled welding tees

- Systems where run i-factors control the solution and d/D ratios < 0.5
- Systems with any component that has questionably high calculated stresses

CAESAR II Integration

FEATools supports code-based pipe, pressure vessel, and tank design. It was developed to interact only with CAESAR II. This means that, once calculated, branch SIFs and k factors are not only seamlessly and automatically transferred to the CAESAR II model, but the software retains the data for future analysis.

CAESAR II Workflow

Because FEATools closely matches the way CAESAR II operates, the current workflows remain virtually unchanged. Users can continue to produce the deliverables that they have come to trust. For time efficiency, the software saves each branch FEA calculation in a database so users can reuse those values on subsequent jobs. If a user wants to return to the original model, the software creates the SIF and k factor-adjusted model as a copy, keeping the original intact.

Components

CAESAR II FEA Translator – Applies more relevant SIFs and flexibility (k) factors for branch connections automatically to the entire CAESAR II input file so FEA or improved correlation methods can be used. Includes the option for light, medium, or heavy walled tees, laterals, and the effect of weld thickness on SIFs and k factors. Intersection type and dimensions can be changed within the program without going back into CAESAR II without modifying the original model.

FESIF, FE107, FETee, FEBEnd, & PRGiK – Individual component FEA analysis programs for more in-depth analysis of important connections or components in your piping system.

About Hexagon

Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

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