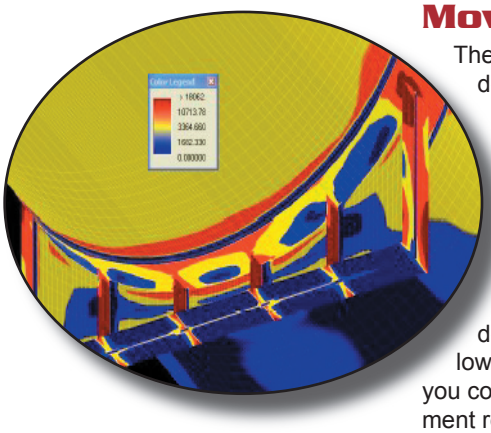
NozzlePRO

NozzlePRO is a template-based finite element software package that allows the engineer to quickly and easily analyze individual nozzles, saddles, pipe shoes and clips.

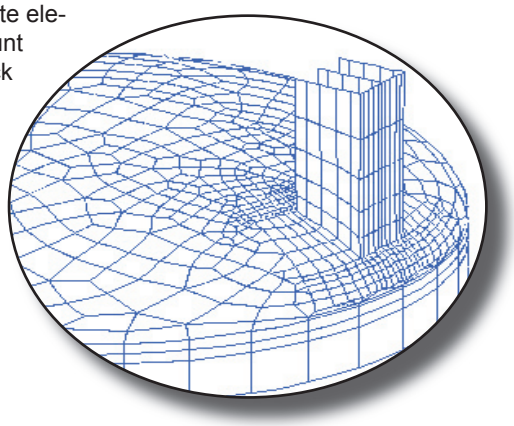
Finite Element Analysis

Moving Beyond WRC & Zick



The standard methods used to analyze pressure vessel and piping systems were developed nearly 50 years ago using limited test data. Design methods presented in WRC107, WRC297 and by L.P. Zick have served the industry well, but have severe limitations. Often, engineers apply these methods far beyond the intended bounds, like putting a square peg in a round hole. For instance, Zick's method never addressed axial loads on saddles - a considerable concern for seismic or offshore applications. And neither WRC's 107 nor 297 provides analyses for the most common element - reinforcing pads.

Finite element technology moves beyond these limitations to allow engineers to design safer equipment more efficiently and cost-effectively. Only **NozzlePRO** allows you to build WRC and Zick geometries with a few clicks on your keypad. When you consider that NozzlePRO provides finite element results from the EXACT SAME amount of information needed to run a WRC or Zick analysis, the advantage is clear.



Making FEA Work for You

NozzlePRO generates graphical and tabular results that clearly describe the situation at hand. The graphics can be viewed with DirectX and vividly display the results of pressure, moments, temperature and loads. The interactive toolbox allows the user to disect and manipulate models.

The tabular results give flexibilities and SIFs that can be put back into a piping or pressure vessel design package, adding greater accuracy and better results.

Nozzles, Saddles, Pipe Shoes & Clips

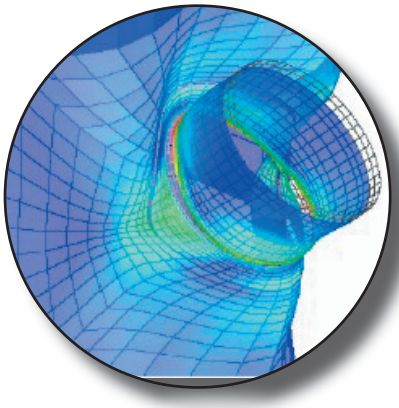
NozzlePRO is designed to quickly and easily evaluate nozzles, saddles, pipe shoes and clips. A variety of head types are allowed including spherical, elliptical, ASME dished, cylindrical and conical. A minimum number of values must be input to generate the model. The engineer is able to include loads such as thermal, weight, operating, occasional, pressure, wind and earthquake. Within minutes you will be able to generate the following:

NOZZLES

- Hillside Nozzles
- Large d/D Ratios
- Size-on-Size
- Optional Reinforcing Pads and Nozzle Inserts

CLIPS & STRUCTURAL ATTACHMENTS

- Select from 10 Different Structural Elements
- Optional Reinforcing Pads
- Unstructured Meshing Options for Heads & Structural Elements

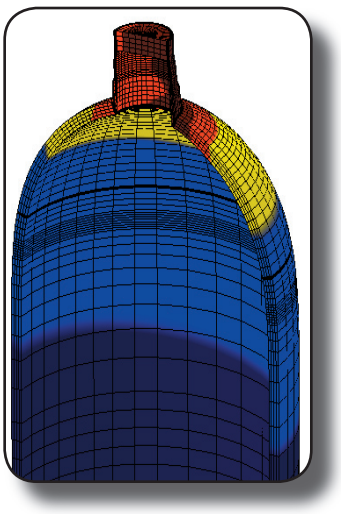


SADDLES & PIPE SHOES

- Tapered Saddles and Pipe Shoes
- Integral & Non-Integral Wear Plates Included for either Saddles or Pipe Shoes
- Include 1 to 10 Web Plates on Saddles

HEAD TYPES

- Elliptical
- Conical
- Cylindrical
- Hemispherical
- ASME Dished
- Flat



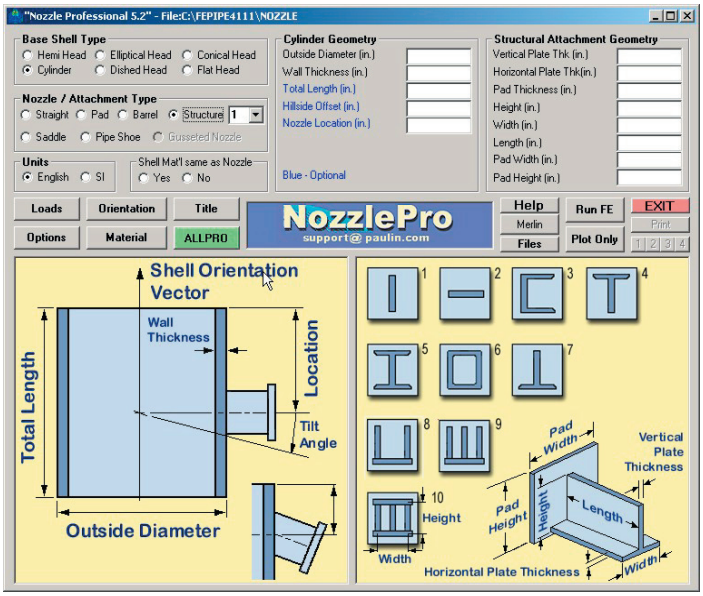
Axisymmetric and Brick Models

NozzlePRO offers optional axisymmetric and brick modeling capability for select geometries. This functionality was added to permit a more accurate analysis of and calculate cyclic pressure stresses in thick-walled intersections; to analyze geometries not directly amenable to shell solutions such as non-integral repads and overturning moments on skirts; and to address basic steady state and transient heat transfer and stress problems.

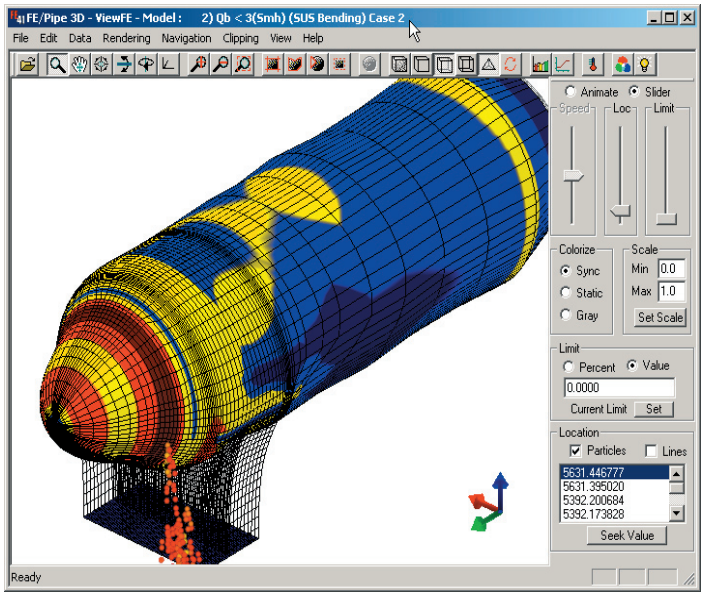
- Nozzles through Blind Flanges in Axisymmetric and Brick Models
- Double Bed Support
- Axisymmetric Horizontal Vessel with Saddles
- Steady State and Transient Heat Transfer for Axisymmetric 2d Elements
- Head Thickness Contours
- Blind or Matching Flange End Conditions for Axisymmetric or Brick Models
- Radiused Welds
- Overturning Moments on Skirts (Brick Models)
- Internal Ring Loads
- Integral and Non-Integral Repads

NozzlePRO is straight-forward and easy to use. Interactive window displays provide graphical input instructions, taking the guesswork out of geometry design. Quickly plot your model for visual verification.

Input Screen



DirectX 3-D Viewer



When You Need to Use NozzlePRO

- When the d/D ratio for a loaded nozzle is greater than 0.5 and WRC 107 or 297 is considered for use.
- When the t/T ratio for a loaded nozzle is less than 1.0 and WRC 107 or 297 is considered for use.
- When the nozzle is pad reinforced and WRC 107 or 297 is considered for use.
- When the number of full range pressure cycles is greater than 7000 and the nozzle is subject to external loads.
- When the D/T ratio is greater than 100 and SIFs or flexibilities are needed for a pipe stress program.
- When the D/T ratio is greater than 100 and a dynamic analysis including the nozzle is to be performed using a piping program.
- When a large lug is used in a heavily cyclic service.
- When pad reinforced lugs, clips or other support are placed on the knuckle radius of a dished head. WRT 107 simplifications for pad reinforced rectangular lug attachments are fraught with potentially gross errors.
- When seismic horizontal loads on vessel clips or box supports are to be evaluated.
- When pad reinforced hillside nozzles subject to pressure and external loads.
- When evaluating large run moments, but small branch moments in a piping system.
- When there are overturning moments on skirts.
- When the effect of integral vs. non-integral pad on nozzle in head should be studied.
- When there are different thermal expansion coefficients or temperatures between the header and branch.
- When the loads on nozzles are high because of the assumption that the nozzle connection at the vessel is a rigid anchor. Few connections at vessels are rigid. Even small rotations can significantly reduce the calculated moment and stress. Accurate flexibilities permit the actual moment on the vessel nozzle to be calculated and included in design.
- When there is heat transfer in an axisymmetric model geometry.
- When the effect of adding a radius to weld geometries on nozzles in heads should be investigated.
- When the anlayst needs to run various model types, comparing results to determine the stability and accuracy of the solution. To verify FEA calculations, NozzlePRO allows nozzles in heads to be analyzed with shell, axisymmetric, or brick finite elements.
- When horizontal vessels are saddle supported, with or without wear plates, and including tapered saddles with many design options.
- When evaluating the effects of axial or transverse loads due to internal sloshing, wind loads, seismic loads, or general external loads. **Zick's methods do not consider either axial or transverse loads.**
- When designing pipe shoes for self-weight, liquid weight and axial loads.

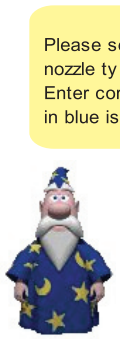
NozzlePRO can be purchased as a single station product or as a network version.

NozzlePRO can be used stand-alone or linked to either COMPRESS or PVElite.

NozzlePRO is included as a module in FE/Pipe.

COMPRESS is fully owned and licensed by Codeware.

PVElite is fully owned and licensed by COADE.



Online documentation and helpful hints from Merlin.

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