Shortening the Design Process through FEA (Pt 2)

New developments in sealing technology require the use of advanced design techniques, and a complete solution requires pre-processing, solution and post-processing for effective nonlinear Finite Element Analysis.

FEA teams need to have access to the latest software for contact, large strain and multi-physics analysis available today to solve static and dynamic nonlinear problems.

Finite element analysis has become a critical part of the seal development process. Many end users claim to have linear analysis capabilities, but few are able to consistently and reliably solve nonlinear sealing problems involving changing contact conditions between components and/or large strain (plasticity or elastomeric behavior, for example).

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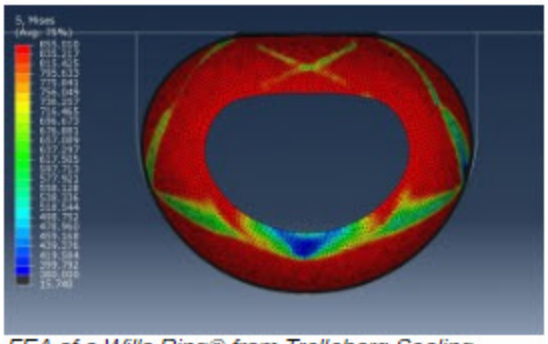
Because of these limitations, there are many aspects of seal behavior that are not well understood until physical prototypes are available. It must be understood that FEA results are not definitive proof of a product or seal's performance. It is an analysis and design tool to be used alongside traditional design tools; FEA should complement the complete design process. Product and seal testing in the lab or field is still needed to prove performance, and using FEA results alone to qualify a product or seal is insufficient. Not fully qualifying the product or seal leads to late and expensive design changes, product failure in the field, and, sometimes, safety issues.



FEA of a Wills Ring® from Trelleborg Sealing Solutions

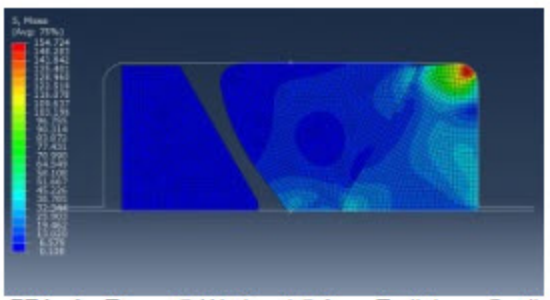
Matching FEA to sealing requirements

FEA capabilities make possible:

Seal failure prediction from cracks, leaks or deformation; allowing us to design a better product or to reverse-engineer existing problems to discover root causes
Assembly force requirements to install the seal; allowing end users to determine whether specific tooling is needed
Temperature simulation to determine effects on various seal materials.
Thermo-viscoelasticity simulation to analyze the effects of creep and viscoelasticity over a period of time, allowing us to determine sealing load long after installation. We also can subject elastomers to tests for properties such as hyperelasticity and Mullin's Effect
Friction analysis to determine breakout torque and running torque of our rotary seals, or actuation force of linear seals

Modeling space within Trelleborg Sealing Solutions includes 2-D models for Axisymmetric, Plane Strain and Plane Stress analysis as well as 3-D modeling of both seals and complex client hardware with exact materials and geometry to determine loading or recommend design changes.

Trelleborg Sealing Solutions can also conduct FEA on composites such as an elastomer with fabric or resin with fabric.



FEA of a Turcon® Wedgpak® from Trelleborg Sealing Solutions

Conclusion

Finite Element Analysis offers important advantages:

It shortens the design optimization process, while improving design and seal performance through integrated software simulation
It provides reliable seal analysis capabilities to reduce development costs and lead times

Developers can greatly enhance and add value to their end product by working with a dedicated sealing solutions provider. Trelleborg Sealing Solutions have led the way in product and process, and continue to seek to be the leader in the models created and materials tested.