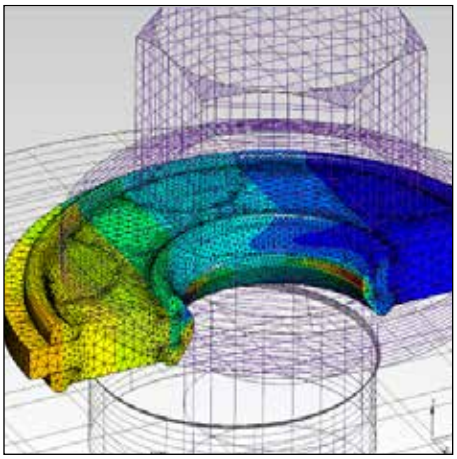
Finite Element Analysis (FEA) Frequently Asked Questions

Composite Sealing Systems ("CSS") Division



Can structural FEA simulation of gasket contact with a cover and base sidewall of a rectangular enclosure give good prediction of seal performance?
If so, what FEA results do you recommend as good predictors of seal performance?
Parker has internal design guidelines for seal contact pressure and stress/strain which are used in conjunction with the compression stack-up to predict seal performance. Of course, FEA is not a substitute for validation testing of physical parts.

Will 2D simulations give useful predictions, or is 3D analysis necessary?
In our experience, 2D simulations are generally more accurate due to the improved mesh density. Of course, each situation is different.

What articles on simulation of enclosure sealing do you recommend?
I assume you're requesting "white papers" or similar information? Parker has developed their own proprietary standard procedures for simulating elastomers through decades of correlation activities between simulation and testing.

What articles on measurement of gasket material behavior for simulation do you recommend?
I assume you're requesting "white papers" or similar information? Parker has developed their own proprietary standard procedures for characterizing elastomers through decades of correlation activities between simulation and testing.

What material behavior model / models do you recommend for FEA simulation of gasket compression?
There are many options, but Parker primarily uses hyperelastic models.

Can you provide material properties of your materials, that we can use to fit material model parameters to?
Parker's materials are proprietary formulas and Parker holds FEA material properties as intellectual property. As an alternative, we provided the predicted compression force for the proposed seal design. We also permit customers to order material slabs and/or buttons to conduct their own material testing for characterization purposes.

What tests do you recommend for determining material property parameters for simulation?
Parker has used several different characterization tests in the past but typically uses uniaxial stress/strain testing.

How important is typical material behavior variation on the simulation?
The variation between batches of material is the biggest source of variation in Parker's simulations.

How important is friction on the sealing performance of extruded hollow gaskets?
This depends on the application and seal configuration. Parker just concluded an internal study on the effects of friction and the correlation to FEA and found that our previous assumptions were generally confirmed.

How does exposure to the environment (temperature cycling, ageing, sunlight, …) affect gasket material properties?
This depends on the material. Parker material data sheets capture some aging effects (the tested cause depends on the specific material). However, Parker does not currently consider (or characterize) material aging in FEA.

Experience using non-linear elasticity vs non-linear viscoelastic for modeling seals.
Parker has previously evaluated viscoelastic models but continues to use hyperelastic models as mentioned above.

What usual field variables (stresses/strains) in the seal are checked after a simulation, e.g., mises stress/strain vs principal stresses/strains.
Parker generally uses Cauchy stress for elastomer, but we would review the MSDS to make sure there's no hazardous components that would require some safety precautions.

Parker Hannifin Corporation
Composite Sealing Systems Division
7664 Panasonic Drive
San Diego, CA 92154
phone: 619 661 7000
www.parker.com/css