Details of Comsol Models

Note: Most of the parameters are defined in the model files.

cylinder_invagination_(v4).mph

This model simulates cell wedging in region 2 at the top of a cylindrical shell. Some things to know about this model:

- The strain-energy density function is a specialized Blatz-Ko:

$$W = C\left[I_1 - 3 + \frac{1-2\nu}{\nu}\left(J^{-2\nu/(1-2\nu)} - 1\right)\right].$$

- The size of region 2 is controlled by the parameter **omega**.

- Circumferential growth in region 2 is specified as a function of R in node **growth - 2**. Circumferential growth in region 1 is governed by the growth law

$$\dot{G} = F, \qquad F = A(\sigma_\theta - \sigma_0)G,$$

and the target stress is governed by

$$\dot{\sigma}_0 = F_\sigma, \qquad F_\sigma = B(\sigma_\theta - \sigma_0)$$

as defined in node **growth -1**. To turn off the growth law, set $A = 0$; to keep the target stress constant (no hyper-restoration), set $B = 0$. ($B < 0$ for HR.)

- By default, the shell is fluid-filled (constant cavity volume). To turn off this constraint, select **Study 1 > Solver Configurations > Solver 1 > Dependent Variables 1 > mod1_pf** and uncheck the **Solve for this field** box in the Settings window.

- The fluid pressure is denoted pf. If fluid is included, it is useful to plot pressure vs time.

sphere_invagination_(v4).mph

This model is essentially the same as the cylinder invagination model, except the initial geometry is a hollow sphere. By symmetry, $G_\theta = G_\phi = G$.

Note: To turn off the fluid in the most recent versions of Comsol, select **Study 1 > Step 1: Time Dependent** and click the green check mark next to PDE (wp) to change it to a red 'X'.