**Supplementary Material A**

for the paper “On theDevelopment of Instabilities in an Annulus and a Shell Composed of a Poro-Hyperelastic Material”

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**Appendix A.**

In this Appendix, we derive analytical solution of the differential equation of equilibrium (4.6) for instantaneous response of poro-hyperelastic cylindrical shell. Consider first the Ogden’s hyperelastic material with . In this case, we have from (4.6)

, (A.1)

which gives us, after satisfying the zero stress boundary condition at the outer surface ,

. (A.2)

Consequently, from the traction boundary condition at the inner surface , we have

. (A.3)

Expressing the stretch  in terms of the stretch  according to (4.3), we can find the applied pressure as a function of the stretch  only

. (A.4)

The critical applied pressure is the maximum pressure that can be applied to the hyperelastic cylindrical shell. This can be found by taking the first derivative of (A.4) with respect to  and equating it to zero. We can show that the applied pressure is maximum when

, . (A.5)

Therefore, the critical applied pressure can be found from the formula

. (A.6)

The fluid pressure can be found from (4.7) as

. (A.7)

It is clear that the fluid pressure is non-uniform across the thickness of the shell and, in addition, it is negative, i.e., the sudden pressurization or increase in the applied pressure  causes a reduction in the fluid pressure.

Consider now Neo-Hookean material, . In this case

. (A.8)

The general solution of the differential equation (A.8) can be represented by

. (A.9)

From the traction boundary condition at the inner surface, , we find

. (A.10)

The maximum applied pressure can be found from (A.10) by taking the limit , assuming that large values of the stretch are indicative of loss of stability. Therefore, we obtain

, (A.11)

since for large stretches, .

The fluid pressure can be found from (4.7) as

. (A.12)