Sulcus formation in a compressed elastic half space

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block of rubber, biological tissue or other soft material is subject to sub-
stantial compression, its surfaces undergo a folding instability. Rather
than having a smooth profile, these folds contain cusps and hence have
been called creases or sulcii rather than wrinkles. The stability of a
compressed surface was first investigated by Biot (1965), assuming the
strains associated with the instability were small. However, the compres-
sion threshold predicted with this approach is substantially too high. I
will introduce a family of analytic area preserving maps that contain
cusps (and hence points of infinite strain) that save energy before the
linear stability threshold even at vanishing amplitude. This establishes
that there is a region before the linear stability threshold is reached
where the system is unstable to infinitesimal perturbations, but that
this instability is quintessentially non-linear and cannot be found with
linear strain elasticity.

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