Straight contact lines on a soft solid LAURENT LIMAT, Laboratoire
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Diderot — Using a Stokes like approach of incompressible elasticity, I calculated
the distortions induced by a straight contact line on a elastic substrate having a
non-zero surface tension. The response is very similar to that of Shanahan and de
Gennes, except that the short scale divergence of the Log profile is regularized by
the elastocapillary length built upon shear modulus and substrate surface tension,
and replaced by a Neumann balance of surface tensions. This method is extended
to treat a substrate surface tension that differs in the dry and wetted regions, i.e.
a contact angle that differs from 90 degrees, with the example of a infinite rivulet
composed of two contact lines connected by a curved, cylindrical, liquid interface.
The perhaps most surprising result is that the local slope of the substrate, very
near contact line, is nearly inversely proportional to the substrate surface tension,
each "side" ("dry" or "wet") of the contact line being very close to support one
half of the applied vertical force. This result has surprising implications for the
approximate treatment of wetting hysteresis on substrates having both plastic and
elastic properties, that seem to be ruled at small scales only by surface tension effects

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