Equilibrium Configurations For A Floating Drop

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Consider two fluids of differnt densities meeting along a horizontal planar interface, with the larger density below and gravity acting downwards. A drop of fluid with finite volume of an intermediate density is introduced between the two other fluids. We study the axisymmetric equilibrium configurations. There are three capillary surfaces which join along a contact circle, and satisfy a force balance equation there. Making use of estimates and monotonicity properties of capillary surfaces due to Finn, Siegel and Vogel and some extensions, we are able to prove existence of a drop of a given radius and under some situations of a given volume. In addition, we obtain the asymptotics of small drops. We also treat the case of a floating bubble in which the density of the upper fluid is the same as that of the bubble and the surface tension between the upper fluid and the bubble is twice the surface tension between the upper and the lower fluids, which is the same as the surface tension between the lower fluid and the bubble. We have proved the existence of a bubble of given radius and obtained the asymptotics for small bubbles. For a sufficiently large radius there is unique bubble. This is joint work with Alan Elcrat and Robert Neel.