

Stanford Department of Mathematics Colloquium

FLOATING BODIES

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Abstract

In classical capillarity theory one assumes a rigid “support” surface (e.g., capillary tube) that is fixed in space, and one seeks to describe the surface of an adjacent liquid (into which the tube has been dipped). For the related problem of a body floating at a liquid/air interface in a gravity field directed toward the liquid, neither the liquid surface nor the rigid support is fixed in space, and each is subject to different kinds of constraints. Thus a new level of complexity appears, and new procedures are needed to obtain useful information. The present work offers an initial effort toward characterizing the configurations that can occur, in accordance with classical energy principles. Several specific problems are addressed, notably that of determining conditions under which a body whose density exceeds that of the ambient liquid will float or sink. The floating configurations correspond to local energy minima that in general are not global, as the energy can be made negatively unbounded by submerging the body to increasing depth.

Criteria for floating are provided in various configurations, covering both the (simpler) two-dimensional case of a long cylinder (needle) of general section floating horizontally, and also a smooth body of general shape. The latter work is joint with Tom Vogel. A case of special interest is addressed in work joint with Mattie Sloss, in which we settle “Problem 19” from “The Scottish Book” of the Mathematical Seminar of Lwow, in the 1930’s, as to the most general shape of a body that will float in every orientation.

Thursday, June 4
4:15 p.m.
Bldg. 380, Room 380-W.

<http://math.stanford.edu/coll/0809/>