An Investigation of Some Pattern Selection Issues in the Rising Plane Taylor Bubble Problem

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Plane Taylor bubbles with correct and incorrect tip angles are numerically generated for the case of zero surface tension (s.t.) using a Fourier collocation method. We find that all of these bubbles satisfy correct asymptotic shape at their tails. We have identified some generic patterns in the behavior of the bubbles with incorrect tip angles. We provide theoretical justifications of these observations and provide some validation criteria for solutions with correct tip angle. We derive a tip angle dependent higher order constraint on the solution at the tip and show this to be a very useful validation criterion. The usefulness of this criterion is exemplified by allowing tip angles of bubbles to be determined numerically. The relevance of our results to accurate computation of the nature of selection mechanism for the zero s.t. limit bubble is discussed.

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