Low-Reynolds-Number gravity-driven migration and deformation of bubbles near a free surface

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The gravity-driven migration of $N \geq 1$ bubble(s) near a free surface is addressed within the assumption of negligible inertial effects by solving a boundary-integral equation at each time and assuming axisymmetric free surface and bubble(s) with axis of revolution aligned with the gravity. The implemented boundary element method permits one to accurately invert at a reasonable cpu time cost the encountered boundary integration on the liquid boundary and to determine the unsteady evolution of the free surface and each bubble boundary. Numerical results given for one or two bubbles show that the film drainage taking place after a pure rising regime between the free surface and the closest bubble or between two bubbles exhibits an exponential behavior in time which depends upon the liquid flow Bond number.