Numerical Modeling of a Liquid Droplet Surface Advection: Some Tests of the Modified VOF Algorithm

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Abstract: The goals of this paper are development and validating of the original computer code based on the algorithm of the Volume-Of-Fluid method [1], which will be the part of the software project for numerical simulation of droplet surface dynamics under the influence of external physical fields (electromagnetic field, in particular). The developed version of the computer code is devoted for tracking of liquid droplet surface in the given velocity field.

To verify the efficiency of the code developed and to estimate the accuracy of the droplet surface representation a series of tests was performed. In the first test series, initially the circular and square liquid regions moved at a constant speed along one of the coordinate axes and along the diagonal. In the second test series, the circular and square liquid regions were placed in a circular velocity field and rotated about 360 degrees around the center of rotation as a solid body. In the third test series a solenoidal velocity field was used in which the initially circular shape of the droplet is stretched and twisted into a spiral around the center of rotation, that is the topology of the liquid droplet has been changed. After a while after the calculation begins, the direction of rotation is reversed and the deformed droplet returns to its original position.

The numerical simulation results shows that in all the tests the original droplet form is preserved with a sufficient degree of accuracy. In the first and second series of experiments the deviation is of the order of 1%, and in the third series the deviation does not exceed 5%. Thus, the computer code developed adequately simulates the position of the droplet surface.

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