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Numerical Study of the Dynamics of Coalescence of Two Bubbles of Air in a Water Column at Rest

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The research of optimization, dimensioning or the implementation of a hydraulic system often reveals nondesired phenomena such as early erosion, the loss of output or the irregularity of the flows due to the presence of bubbles. The experimental study of the flows with bubbles being very complex, it appears paramount theoretically to analyze the transfers which are carried out with the interface of one or more bubbles of air and their medium. We present a numerical study of the dynamics of coalescence of two bubbles of air in a water column at rest. We used the PLIC-VOF method developped by Hirt & Nichols to analyse the change of topology with the surface tension force variation. The resolution of the Navier–Stokes equations is carried out by using a Projection method with a significant pression dependance in time. The use of a time pressure correction permit to change initial pressure and the behaviour of a rise bubble is more accuracy well predicted. For the study of coalescence between the rises of two bubbles we developped a new approach of the calculation of the voluminal force of surface tension, as well as an evolution of the resolution of the equation transport of the function of phase f(x, y, t). The results are presented in the form of curves and succession of images and show a very good behavior of the algorithms in front of the tests of validation as well as a better estimate of the force of surface tension. The evolution of the contour and the fields speed room of two bubbles in interaction is modelled and presented in the form of a succession of images representing the approach and coalescence in 2d of two bubbles for different Reynolds number and of Jump.

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