PhD in Energy and Mineral Engineering at PSU

Nicolás's Research - Reports

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Considerations

Test the pseudopotential approach for multicomponent partially miscible mixtures, under the action of a second force, as gravity.

The partition scheme can be proven to work for different Reynolds and Bond (Eotvos) numbers, depicting particular bubble shapes as found by Flit R, Grace JR, Weber M. Bubbles, drops, and particles. New York: Academic Press; 1978.

$$R_e = \frac{\rho_l u_b d_0}{\mu_l} = \frac{u_b d_0}{\nu_l}$$

$$B_o = \frac{g \Delta\rho d_o^2}{\sigma}$$

If we fix thermodynamic conditions, $\rho, \Delta\rho, \sigma$ will be fixed. Redifining R_e:

$$Re = \frac{\sqrt{g d_0} d_0}{\nu_l} = \frac{\sqrt{g d_0^3}}{\nu_l}$$

We can sweep the spectrum by fixing g (fixes B_o), and moving ν_l (fixes R_e), as:

$$\nu_l = c_s^2(\tau_l - \frac{\Delta t}{2})$$

$$g = \frac{B_o \sigma}{\Delta\rho d_o^2}$$

$$\nu_l = \frac{\sqrt{g d_o^3}}{R_e}$$

$$\tau_l = \frac{\nu_l}{c_s^2} + \frac{\Delta t}{2}$$

Domain
Fluid conditions. Static simulation (first attempt) with:
$\Delta\rho = 7.59285$, $d_o = 29.45$, gives $\Delta P = 0.00377616$ (with negative value for the liquid).
$\sigma = 0.1112$, given that Shan-Chen G=-1.0.

Boundary conditions (this may not be considering the hydrostatic column)
Parameters

Spherical regime

First case (150 x 300)

- $g = |\mathbf{g}| =$ -1e-6. $B_o = 0.0592$. $\tau_l = 2.0$, $\nu = 0.5$. $u_b = 0.0121$.
- $R_e^{\text{org}} = 0.713$. $R_e^{\text{mod}} = 0.320$.
- This is spherical regime, and far away from the other regimes according to the Grace's plot.

Ellipsoid case (150 x 300)

- $g = |\mathbf{g}| =$ -1e-5. $B_o = 0.592$. $\tau_l = 0.51$, $\nu = 0.0033$. $u_b \approx = 0.35$.
- $R_e^{\mathrm{org}} = 3092$. $R_e^{\mathrm{mod}} = 151.61$
- This simulation is approaching to the Mach velocity limit and a perturbation is moving the bubble from the axis. I decided to open the channel more to avoid the interaction with the wall. I have reasons to believe that the movement beyond the axis is due to whom the corner was assigned to (number of boundary).

Ellipsoid case (300 x 300)

- $g = |\mathbf{g}| =$ -1e-5. $B_o = 0.592$. $\tau_l = 0.51$, $\nu = 0.0033$. $u_b \approx = 0.35$.
- $R_e^{\mathrm{org}} = 3092$. $R_e^{\mathrm{mod}} = 151.61$
- The ellipse shape of the bubble was better seen in this case, although eventually it moves away from the center. For the most part of the simulation, the ellipsoid maintains, although it is important to understand if the viscosity of the gas phase plays any role in the deformation (”plasticity” of the bubble).

Dimples

Dimples case (300 x 300)

- $g = |\mathbf{g}| =$ -2e-3. $B_o = 118$ $\tau_l = 0.72$, $\nu = 0.07348$. $u_b \approx =$.
- $R_e^{\text{org}} =$. $R_e^{\text{mod}} = 100$
- The gravity value is too high and the method is diverging too soon. Not even with G = -0.1 or g = 1e-4.

Dimples case (3000 x 3000)

- $d_o = 300$. $g = |\mathbf{g}| =$ -1e-5. $B_o = 61$. $\tau_l = 0.993$, $\nu = 0.164$ $u_b \approx =$.
- $R_e^{\text{org}} =$. $R_e^{\text{mod}} = 100$
- Did not run

Dimples case (3000 x 3000)

- $d_o = 300$. $g = |\mathbf{g}| =$ -1e-5. $B_o = 61$. $\tau_l = 5.43$, $\nu = 1.64$ $u_b \approx =$.
- $R_e^{\text{org}} =$. $R_e^{\text{mod}} = 10$
- Did not run

Discussion

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Main discussion points:

- Topic 1
- Topic 2

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And finally everything will be there

Sample frame title

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Remark

Sample text

Important theorem

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Examples

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Two-column slide

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$$E = mc^2$$

- First item
- Second item

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