Laboratory work description

Continual modeling by smoothed particles (hydrodynamics) method

1. PURPOSE OF WORK

Acquaintance with smoothed particles methods and smoothed particles hydrodynamics approach and study the main feature of it: extra compressibility of liquid.

2. CONTENT OF WORK

Laboratory work includes:

1. Simulation of cavity flow by SPH method. Illustration of obtained fields of velocity and density in a state of stationary flow.
2. Investigation of a relation between critical integration timestep and wave speed in equation of state in the liquid. Illustration of dependencies between critical timestep and wave speed in equation of state. The critical timestep is a largest timestep when calculation is still stable.
3. Investigation of a relation between density deviation range and wavespeed in a liquid, wavespeed in a liquid and time of establishment of the flow. Illustration of obtained dependencies.

A laboratory work report includes the report text, input configurational file for LAMMPS, files with results of calculations for most important states selected during the study.

VARIANTS OF TASK

1. Cavity flow with constant velocity of upper wall 0.1 m/s and account of gravity (9.8 m/s^2) and heat transport in bulk of liquid. Upper wall temperature is 320K, temperature of other walls and of the liquid 290K. Liquid density is 1000 kg/m^3, viscosity 1e-3 Pa·s.

2. Cavity flow with constant force applied to the upper wall and equal to 0.5N. Density of upper wall is 2000 kg/m^3, friction of upper walls and sidewalls is neglected, account of heat transport in bulk of liquid. Upper wall temperature is 320K, temperature of other walls and of the liquid 290K. Liquid density is 1000 kg/m^3, viscosity 1e-2 Pa·s.

3. Cavity flow with constant velocity of left sidewall 0.1 m/s, account of gravity (9.8 m/s^2) and heat transport in bulk of liquid. Left wall temperature is 320K, temperature of other walls and of the liquid (water) 290K.

4. Cavity flow with constant velocity of left sidewall 0.1 m/s and account of gravity (9.8 m/s^2). The cavity is filled by liquids of two types. Low-weight liquid with density 900 kg/m^3 fills lower half of the cavity, hi-weight liquid with density 1100 kg/m^3 fills upper half of the cavity in initial time moment.

5. Cavity flow with constant velocity of left sidewall 0.1 m/s and account of gravity (9.8 m/s^2). The cavity is filled by liquids of two types. Low-weight liquid with density 900 kg/m^3 fills left half of the cavity, hi-weight liquid with density 1100 kg/m^3 fills right half of the cavity in initial time moment.