

Mechanical Engineering Master's Defense

The C++ implementation of refined level set grid (RLSG) method

School for Engineering of Matter, Transport and Energy

Salar Safarkhani

Advisor: Dr. Marcus Herrmann

abstract

In this thesis, a FORTRAN code is rewritten in C++ with an object oriented approach. There are several reasons for this purpose. The first reason is to establish the basis of a GPU programming. To write programs that utilize GPU hardware, we need to use CUDA or OpenCL which only support C and C++. We can use a feature of FORTRAN that lets its programs call C/C++ functions. FORTRAN sends relevant data to C/C++, which in turn sends that data to OpenCL. Although this approach works, it makes the code messy and bulky and in the end more difficult to deal with. Moreover, there is a slight performance decrease from the additional data copy. This motivates us to have the code entirely written in C++ to make it more uniform, efficient and clean. The second reason is the object oriented feature of the C++. The “abstraction”, “inheritance” and “run-time polymorphism” features of C++ provide some form of classes and objects, the ability to build new abstractions, and some form of run-time binding, respectively. In recent years, some of popular codes has been rewritten in C++ which were initially in FORTRAN. One of these softwares is LAMMPS.

In this code we solve the level set equation by RLSG method to track the interface in two phase flow. In gas/fluid flows, the surface tension is important and only exists at the interface. Therefore we need to evaluate the location and some geometric features of interface that can be achieved by solving level set equation.



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