

Optimisations and Parallelism of d2q9-bgk.c

George Herbert
cj19328@bristol.ac.uk

February 19, 2022

Abstract

d2q9-bgk.c implements the Lattice Boltzmann methods to simulate a fluid density on a lattice. The original d2q9-bgk.c code was unoptimised and not parallelised. This report outlines the techniques I utilised to optimise and parallelise d2q9-bgk.c, as well as a detailed analysis of those techniques. To do so, this report is split into several sections corresponding to different iterations of my code.

1 Original code

2 Serial optimisations

2.1 Compiler

2.2 Code changes

2.3 Results

3 Vectorization

3.1 Code changes

3.2 Results

4 Parallelism

4.1 OpenMP

4.2 Results