

# CAS 741: Problem Statement

## Commonality, Variability, and Implementation of Lattice Boltzmann Solvers

Peter Michalski  
000653483

2018-12-16

Table 1: Revision History

Date	Developer(s)	Change
2018-12-17	P. Michalski	Initial Draft

## Problem

The Lattice Boltzmann methods (LBM) are a powerful technique to simulate multi-phase and multicomponent fluid dynamics using a mesoscopic distribution function. The LBM have grown in popularity since its inception and there are now several open-source implementations of LBM for simulating fluid dynamics over a range of parameters. These implementations are of varying complexity and they offer many distinct parameter options, which can be challenging for the user.

## Solution

This project will conduct a commonality analysis for the aforementioned family of LBM solvers, and will attempt to distinguish key solver functionality. A new solver will be built that will include the most important features found in the commonality analysis, providing the user with a basic, easy to use, implementation of LBM.

## Context

### Environment

The solver will be compatible with KDE neon 5.16 (Ubuntu 18.04 LTS) and macOS 10.13.6. Compatibility with other operating systems will not be guaranteed.

## **Stakeholders**

Stakeholders include:

- Dr. Spencer Smith
- Dr. Jacques Carette
- Ao Dong
- Other members of my M.Eng project team
- Individuals studying or working with Lattice Boltzmann implementations