

Computational Science is an up-and-coming branch of science that uses advanced (parallel) computing technology to understand and consequently solve complex physical and mathematical models. These models are Algorithms, Computer Hardware, and Computing infrastructures.

1. Algorithms are mathematical models, computational models and computer simulation developed to solve sciences (physical and mathematical).
2. Computer hardware is developed to optimize the advances in cluster and parallel development.
3. The computational infrastructure that supports solving science and engineering models.

In this particular controlled environment ANSI C and C++ compilers capabilities like multi-process and multi-threading are extended utilizing Cuda, Message Passing interface (MPI) and Open Multi-Process (OpenMP) libraries. Various Mathematical models like Linear Algebra and matrix manipulation are modeled and implemented in Ubuntu 22.04. These examples could be used as building blocks to implement more complex models. Analysis of the solutions has shown advantages and disadvantages for each technique. Cuda is advantageous in matrix manipulation when matrix elements are in many millions. Open-MPI is advantageous when the solutions are to be distributed across multiple nodes of networks (multiple platforms and operating systems), Open-MP is advantageous when inter-process communication is expensive and memory resources are limited and expensive hardware and drivers clusters are not available.