

# TDTS08: Lab Report

Lab 5

<b>Name</b>	<b>PIN</b>	<b>Email</b>
Alexander Yngve	930320-6651	aleyn573@student.liu.se
Pål Kastman	851212-7575	palka285@student.liu.se

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## 1 Introduction

The article we have choosen is *Numerical Parallel Processing Based on GPU with CUDA Architecture* written by *Chengming Zou, Chunfen Xia, Guanghui Zhao* at the *College of Computer Science and Technology Wuhan University of Technology Wuhan, China*, which is number 15 in the list of articles.

We choose this article because we didn't have a lab about multicore processors and GPUs and we wanted to explore this area further, but also because we think this area is very interesting and that we will se a lot of development in this area over the next few years.

## 2 Overview

The article compares CPUs and GPUs, and looks at how a GPU can be used in high density parallel computing because it has multi-stream processors which can operate independently and concurrently at high speeds.

The article is about the differences between CPUs and GPUs and how GPUs can be used for calculations in a faster way than in the CPU. The major advantages with GPUs is that is it able to compute a lot of calculations in parallel independent of each other, this means that the CPU is able to only handle branches and control instructions that needs to be controlled allowing the hardware of GPUs to be simplified a lot because their controlling unit can be smaller. However, it should be noted that it needs to be made sure that the data sent to the GPU contains as few branches and control instructions as possible leaving them to the CPU.

## 3 Architecture

The architecture presented in the paper is NVIDIAs CUDA (Compute Unified Device Architecture) architecture, used in NVIDIA GPUs since the G80 which was released in 2006. The CUDA architecture consists of both hardware (graphics card) and software (compiler, libraries and drivers).

The main control flow of the program is executed by the CPU and the GPU is used as a coprocessor. This way the low latency CPU executes the serial instructions and deals with branching and control and the GPU is used for heavy parallel computations. The CPU copies instructions and data from main memory into memory on the graphics card and then starts execution on the GPU. When the computations on the GPU are finished the result is written back into main memory.

The experimental results clearly show that parallel computation is faster on GPUs. It was also found that the performance increase of the GPU over the CPU increases as the problem size increases, further strengthening the authors argument.

## 4 Conclusion