

# Master's Dissertation at the Div. of Structural Mechanics



## IMPLEMENTING A FLEXIBLE DISTRIBUTED PARALLEL FINITE ELEMENT SOLVER

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### *Report*

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### **Background:**

Parallel computing is becoming more and more important in modern Finite Element Software. As problems grow larger, computation on a single processor may not be fast enough. To overcome this problem, one can utilize parallel programming using e.g. smp-machines or clusters.

Furthermore, when local compute resources are scarce, it can be quite convenient to take advantage of non-local resources for performing the calculations.

### **Task:**

The purpose of this thesis work is to investigate some ways of parallelizing existing Finite Element Code. There are several ways to do this, we will be focusing on openMP, PETsc and intel MKL.

- OpenMP is a set of compiler directives that can be directly inserted in to existing code.

- PETsc is a library for solving partial differential equations using the Message Passing Interface, MPI.

- Intel MKL is a library of threaded math routines based on openMP. It is highly optimized for Intel processors.

Also, we would like to investigate the possibility of distributing the calculations to non-local resources using e.g. the Internet Communications Engine (ICE). It would be optimal if the user could utilize the non-local resources by the click of a button.



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