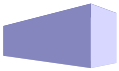

Technische Universität München
Chair of ...

SOME PHD TITLE

Max Muster

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Zusammenfassung

Deutsche Version

Abstract

English version

Acknowledgments

This dissertation was written from 2011 to 2014 during ....

Max Muster
Technische Universität München
December 3, 2021

Contents

An investment in knowledge
pays the best interest.

Benjamin Franklin

CHAPTER 1

INTRODUCTION

"Storm caused wind turbine fire"[1] this headline news is one which the manufacturers and designers of wind turbines try to avoid. The failure or wrong design of a wind turbine shut down mechanism can have a catastrophic consequence as shown in Figure 1.1.

Vector x x: $\boldsymbol{x}$ $\boldsymbol{\alpha}$
Matrix X X: $\boldsymbol{X}$ $\boldsymbol{\Gamma}$
Tensor x: $\boldsymbol{x}$ $\boldsymbol{\alpha}$
Tensor X: $\boldsymbol{X}$ $\boldsymbol{\Gamma}$

$\vec{\alpha}$

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[1] `http://www.bbc.co.uk/news/uk-16115139` British Broadcasting Corporation [0]

Figure 1.1: Exploded wind turbine in Ardrossan, North Ayrshire, Scotland due to high winds and problems with the emergency shutdown British Broadcasting Corporation [0]

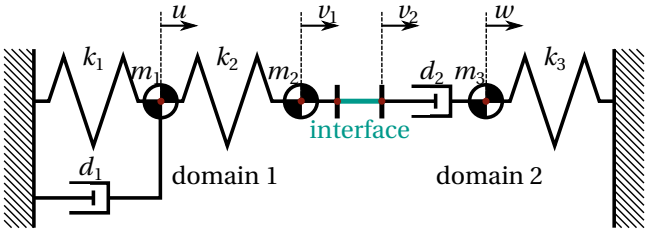

Figure 1.2: Monolithic/co-simulation test problem

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Definition 1.1: (Physical) Field

" A field is a physical quantity that has a value for each point in space and time. "[a]

[a] Gribbin [0]

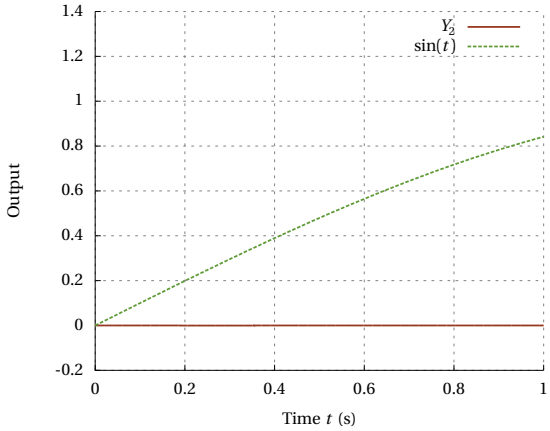

Figure 1.3: Solution over time

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Table 1.1: Behavior of the quasi Newton method...

iteration	$\left\|F({}^m x)\right\|$	$\left\|{}^m \Delta x\right\|$	${}^m e_{\text{fixP}}$
0	1.414 213 562 373 095 1	1.414 213 562 373 095 1	0.303 492 827 833 503 6
1	0.425 916 830 318 592 3	0.327 334 062 994 542 8	0.023 841 235 161 039 2
2	0.033 715 001 075 671 5	0.024 010 670 132 413 9	0.000 169 434 971 374 6
3	0.000 239 617 233 885 1	0.000 169 442 940 232 9	0.000 000 007 968 858 3
4	0.000 000 011 269 667 6	0.000 000 007 968 858 4	0.000 000 000 000 000 2

Appendices

ALGEBRAIC LOOPS

Figure A.1 which is causing the algebraic loop.
.. in Listing A.1 for the server and in ..

A.1 Listing: server.c

```
// C99
// Start program: mpirun -np 1 server
#include <mpi.h>
#include <omp.h>
#include <stdio.h>
#include <stdbool.h>
#include <unistd.h> // needed for sleep() on POSIX system

#define MAX_DATA 100
int main( int argc, char **argv )
{
    int providedThreadSupport;
    bool terminateListening = false;
    char portName[MPI_MAX_PORT_NAME];
    MPI_Init_thread(&argc, &argv, MPI_THREAD_MULTIPLE, &
        providedThreadSupport);
    if (MPI_THREAD_MULTIPLE != providedThreadSupport) {
        printf( "Requested MPI thread support is not guaranteed.\n
            ");
    }
    MPI_Open_port(MPI_INFO_NULL, portName);
    printf("Server available at port:%s\n", portName);
    #pragma omp parallel num_threads(2) shared(portName,
        terminateListening)
```

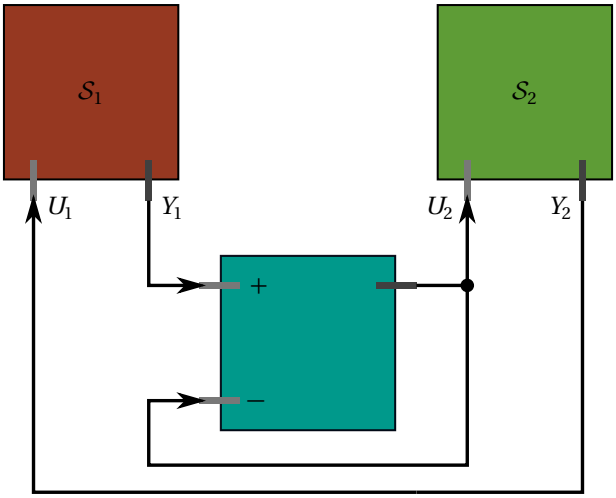

Figure A.1: Block diagram that describes the algebraic loop example

```
    {
24      // Use OpemMP section construct for function parallelism
        #pragma omp sections
26      {
            #pragma omp section
28          {
            // Do some work
30          sleep(15);
            // Connect to yourself in order to terminate listening
32          terminateListening = true;
            MPI_Comm dummy;
34          MPI_Comm_connect(portName, MPI_INFO_NULL, 0,
                 MPI_COMM_WORLD, &dummy);
            printf("Server is connected to itself.\n");
36          MPI_Comm_disconnect(&dummy);
            printf("Server is disconnected.\n");
38          MPI_Close_port(portName);
            }
40          #pragma omp section
            {
42          // Listening section
            while (1) {
44              MPI_Comm interClient = MPI_COMM_NULL;
                MPI_Comm_accept(portName, MPI_INFO_NULL, 0,
                     MPI_COMM_WORLD, &interClient);
46              if (terminateListening == true) {
                    break;
48              }
                MPI_Status status;
50              char clientName[MAX_DATA];
```

```
                MPI_Recv(clientName, MAX_DATA, MPI_CHAR,
                     MPI_ANY_SOURCE, MPI_ANY_TAG, interClient, &
                     status);
52              printf("Client is connected with name: %s\n",
                     clientName);
                MPI_Comm_disconnect(&interClient);
54              printf("Client is disconnected.\n");
            }
56          }
        } // End of sections
58  } // End of parallel section
    MPI_Finalize();
60  return (0);
}
```

BIBLIOGRAPHY

[0] British Broadcasting Corporation. *Storm caused wind turbine fire*. Dec. 2011. URL: http://www.bbc.co.uk/news/uk-16115139.

[0] E. N. Dvorkin and K.-J. Bathe. "A continuum mechanics based four-node shell element for general non-linear analysis." In: *Engineering computations* 1.1 (1984), pp. 77–88.

[0] J. Gribbin. *Q is for Quantum: Particle Physics from A-Z*. Universities Press (India) Pvt. Limited, 1998. ISBN: 9788173712432.