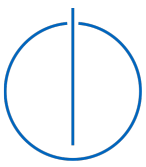
DEPARTMENT OF INFORMATICS

TECHNISCHE UNIVERSITÄT MÜNCHEN

Master's Thesis in Informatics: Computational Science and Engineering

# Thesis title

**Ravil Dorozhinskii**



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# Titel der Abschlussarbeit

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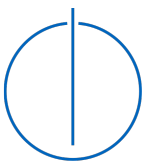
| Author: | Ravil Dorozhinskii |
| Supervisor: | Supervisor |
| Advisor: | Advisor |
| Submission Date: | Submission date |



I confirm that this master's thesis in informatics: computational science and engineering is my own work and I have documented all sources and material used.

Munich, Submission date Ravil Dorozhinskii

# Acknowledgments

# Abstract

# Contents

# 1 Road Map

- GRS - multiple numerical packages to solve complex multiphysics task
- Idea of NuT: an universal mathematician
- NuT Architecture (client server)
- NuT is a wrapper of PetSc
- Typical numerical problem: Navier Stokes equation (time integration)
- Newton's method, Jacobian, Coloring
- Tasks: double buffer, data redundancy, so on
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# 2 Introduction

Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) conducts research and analysis in its fields of reactor safety, radioactive waste management,radiation and environmental protection. GRS is a leading expert organization in the field of radioactive waste management and nuclear safety.

The company has developed numerous different numerical applications and packages for the needs of nuclear safety analysis for the past 40 years. Bellow one can see the list of the main scientific applications developed by GRS.

- ASTEC: integral code for determination of the source term during core meltdown for the primary circuit and containment of LWRs
- ATHLET: thermohydraulic safety analyses for the primary circuit of LWRs
- ATHLET-CD: analyses of accidents with core meltdown and fission product release for LWRs
- ATLAS: analysis simulator for interactive handling and visualisation of several computer codes
- COCOSYS: analyses of severe incidents in the containment of LWRs
- DORT/TORT: solution of time-dependant neutron transport equations for 2D/3D transients analyses
- QUABOX/CUBBOX: 3-D neutron kinetics core model
- SUSA: uncertainty and sensitivity analyses
- TESPA-ROD: core rod code for design basis accidents

Some applications can work together or with other external libraries and applications during a simulation with the aim of solving some multi-physical problems. Figure 2.1 schematically shows an example of application coupling for an involved severe accident simulation.

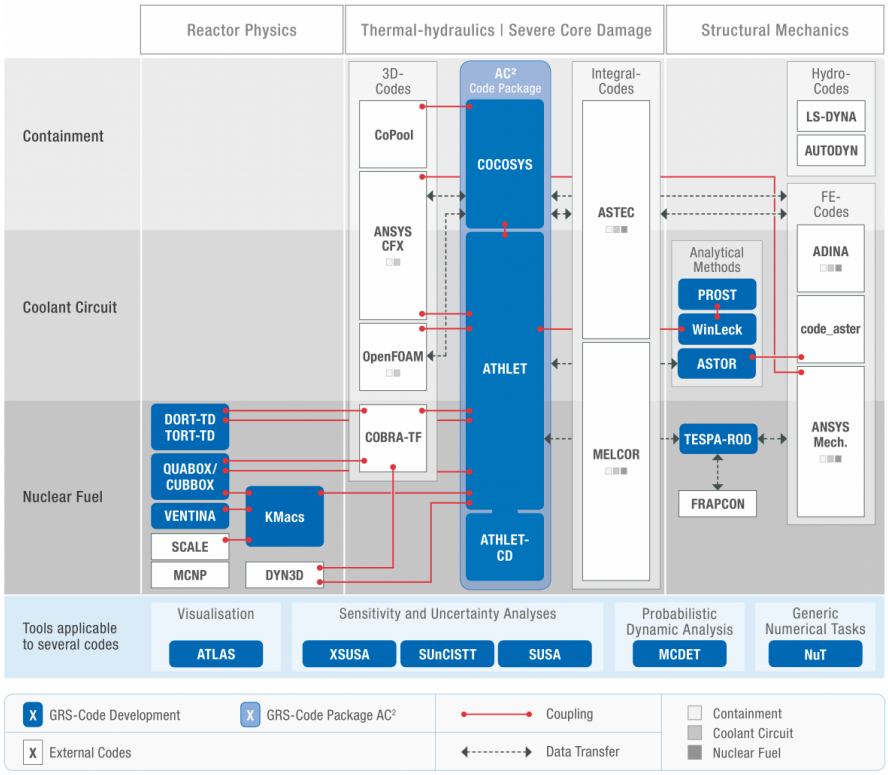


Figure 2.1: An example of application coupling

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