TUM Practical Research Experience Program (PREP)

Your Summer in Munich, Your Research in Excellence

www.international.tum.de/en/prep
Overview

- Munich - Your place of summer research
- The Technical University of Munich (TUM)
- PREP – The Practical Research Experience Program
- Questions
Introduction to TUM
Study in Munich – with Europe at Your Doorstep
Munich at a Glance

- Economic Situation I Employment
- Innovation / Business Creation
- Safety

- 1.3 million inhabitants (3rd largest city in Germany)
- Technology and innovation hub
- Countless activities in Munich and around
  - River surfing in the English Garden
  - Hiking in the Alps
  - Swimming in crystal-clear mountain lakes
  - Enjoying opera or ballet performances
  - Visiting famous cultural sites

(Image: München Tourismus)
Impressions of Munich
TUM at a Glance

- **Students**: >41,000 (34% female, 24% international)
- **Professors**: 545 (as of 2016)
- **Faculties**: 14
- **Degree Courses**: 172 (99 Masters, ~40 in English)

**University of Excellence since 2006**

**No. 1: German Technical University | Top 4 in Europe**

**No. 1: Innovative University in Germany**

**No. 1: International University in Germany**

- **Entrepreneurial**: 800+ Start Ups since '90
- **Global**: >100 international partners

(Image: Andreas Heddergott / TUM)
Grand Societal Challenges

Natural Resources

Health Nutrition

Energy Climate

Infrastructure

Mobility

Communication Information

TUM Practical Research Experience Program
The Practical Research Experience Program (PREP)
PREP – Your Summer at TUM

Research Project Participation
June 04 – August 10
Supervised by a researcher

Framework Program
Industry Visits
Excursions
Local Activities
Student Buddies

Central Services
Scholarship
Dorm Offer
Designated Program Manager

PREP 2017 (Image: Ulrich Benz / TUM)
(Image: Bianca Filart / PREP 2017)
Program Prerequisites

Your Profile:

- Level:
  Undergraduate or graduate student (at least 2 years of undergraduate studies completed upon arrival to TUM)

- GPA:
  3.0 or better (4.0 scale)

- Project-specific Skills

- Social and communicative skills
PREP Projects (I) – Available Disciplines 2018

- Architecture
- Sports/Health
- Informatics
- Mathematics
- Life Sciences
- Civil Eng.
- Electr. Eng.
- Chemistry
- Management
- Medicine

(Image: Thorsten Naesser /TUM)

TUM Practical Research Experience Program
PREP Projects (II)

- PREP 2018: 54 projects offered in 11 faculties


- Projects list specific prerequisites and ECTS credits (if applicable)

- In your online application, you may choose to apply for two projects, but will be asked to rank your choices

- TUM International Center will try to place you according to your prioritizations
PREP Projects (III): Project description

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Project Overview

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Efficient complex frequency-time-domain method for nonlinear soil-structure-interaction systems subjected to dynamic loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUM Department</td>
<td>Department of Civil, Geothermal and Environmental Engineering</td>
</tr>
<tr>
<td>TUM Chair / Institute</td>
<td>Chair of Structural Mechanics</td>
</tr>
<tr>
<td>Research Area</td>
<td>EN Dynamic, Structural Dynamics, Earthquakes, Dynamic Loads, Tsunami Transformation, Iterative Solution Algorithm of Differential Equations</td>
</tr>
<tr>
<td>Project Supervisor</td>
<td>En.-Ing. Francesca Tabassi</td>
</tr>
<tr>
<td>Project Supervisor</td>
<td>E-mail: <a href="mailto:Francesca.Tabassi@tum.de">Francesca.Tabassi@tum.de</a> Phone: +49.89.289.26326</td>
</tr>
</tbody>
</table>

Project Description

Motivation
Nonlinear-soil-structure-interaction (SSI) systems subjected to dynamic forces are usually simulated by transient time-domain nonlinear methods (TNNM). For SSI problems TUMN are computational expensive and sensitive to errors. The soil is usually characterized by frequency-dependent properties, and it is efficiently modeled in the frequency domain. Therefore, an alternative to the TNNM is the hybrid complex frequency-time domain method (HCFDM) which combines the advantages of both methods and increase efficiency. The idea is to represent the behavior of the nonlinear elements of the system through frequency-dependent parameters and to simulate closely the actual nonlinear problem by means of linear analyses in which the stiffness matrix and the damping change with frequency. Finally, through an iterative algorithm the converged solution in time-domain is obtained.

Task
The aim is to implement HCFDM algorithm for non-linear soil-structure interaction problems in Matlab.
The thesis involves the following steps:
1. Literature research on frequency-domain representation of nonlinear phenomena [1].
2. Modelling of the soil-foundation part with the aid of the ITM-FEM method.
3. Modelling of the structure with FEM or by other discrete method. Possible example structure are multi-storey buildings.
4. Implementation of the HCFDM algorithm for the ITM-FEM system, considering only the structural part as a non-linear part [2].
5. Verification of stability and accuracy of the algorithm.


ECTS Credits (max.): 10 (passable otherwise at least 85%)
Number of hours: At least 25 hours/week

Prerequisites

<table>
<thead>
<tr>
<th>Level / Year of Enrollment</th>
<th>Undergraduate (3rd Year)</th>
<th>Senior Undergraduate (5th Year) or Graduate</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites – Subject-related</td>
<td>Solution of differential equations, General Dynamics, Structural dynamics, Soil dynamics</td>
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<td></td>
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<tr>
<td>Prerequisites – Other</td>
<td>A minimum knowledge of programming</td>
<td></td>
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</tbody>
</table>
Application and Admission Procedure

Online Application
- Application Form
- Letter of Motivation (1 per project)
- Resume
- Transcript of Records
- Letter of Recommendation
- Photo (passport sized)
- Confirmation of Insurance

Placement and Admission
- TUM International Center will rank and then forward applications to project supervisors
- Highly competitive admission process
- Admission letters will be sent out presumably in late January 2018

Deadline: December 1st

Application platform available at www.international.tum.de/en/prep
Online Application

You may find further information on the application procedure at our homepage: www.international.tum.de/en/prep
Estimated Expenses

**TUM Scholarship:** 1,500 € (for students not sponsored otherwise for PREP)

**Accommodation (dorm):** ~ 900 € - 1,800 € (totals for entire stay)

**Cost of Living:** ~ 600 € - 1,500 € (totals for entire stay)

**Enrolment Fee:** ~ 130 €

**Semester Ticket (public transport):** ~ 200 € (recommended)

**[Dorm Security Deposit: ~ 500 € (refunded shortly after the student's stay)]**

**Total per student:** ~ 330 € - 2,130 € (security deposit not included)

- Some expenses will be due before arrival
- Not included: Expenses related to travel, visa and (mandatory) health insurance
Did your PREP experience as a whole meet your expectations?
- It exceeded my expectations: 42%
- It met my expectations: 58%

Will you recommend the participation in a PREP project to your fellow students?
- Yes, definitely: 89%
- Maybe: 11%

Do you think that your participation in a research project at TUM will upgrade your resume?
- Yes: 79%
- Maybe: 21%
PREP 2017 – Student Feedback (II)

Did your participation in the PREP project lead to a further cooperation with your supervisor or TUM in general?

- Yes, I participated in the publication of a paper. 16%
- Yes, we will publish a joint paper. 10%
- Yes, other 32%
- No 42%

Yes 58%
PREP Kick-off 2017
PREP Projects 2017

(Images: Ulrich Benz / TUM)
PREP Closing Event 2017
Any questions left?

You can always contact us via the contact details below.
Thank you for your Attention!

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www.international.tum.de/en/prep