TUM Origin in 1868
King Ludwig II founded the „Polytechnische Schule“
… and some castles

www.schlosslinderhof.de
www.neuschwanstein.de
www.herrenchiemsee.de
TUM History

Some milestones

1868  King Ludwig II founds the "Polytechnical School"
1877  Renaming to "Technical University"
1901  Right to Award Doctorates
      First Doctoral Candidate: Georg Hauser (Chemistry)
1905  Admittance of Female Students
      First Female Doctoral Candidate: Amalie Baur (Chemistry)
1930  Integration of the College of Agriculture and Brewing in Weihenstephan
1957  First Neutron Research Reactor in Germany
1967  TUM School of Medicine, University Hospital
1970  Presidential Constitution, "Technische Universität München"
1999  TUM’s University Reform started, Entrepreneurial University Constitution
2000  TUM School of Life Sciences Weihenstephan (Matrix Structure)
2000  Foundation of the COME program

TUM History

Some more milestones

2002  TUM Branch in Singapore: TUM. Asia Pte. Ltd.
      TUM School of Management / Dep. of Sport & Health Sciences
2004  High-Flux Research Source Heinz Maier-Leibnitz
2005  TUM Institute for Advanced Study (IAS)
2006  TUM elected "University of Excellence"
      TUM Int. Graduate School of Science and Engineering (IGSSE)
2009  TUM School of Education / TUM Graduate School
2010  TUM Munich School of Engineering (MSE)
2012  TUM again elected "University of Excellence"
      Munich Center for Technology in Society (MCTS)
2014  Bavarian School of Public Policy
2015  Munich School of Bioengineering
2018  150 years jubilee Technical University of Munich
2019  TUM "University of Excellence“ for the third time
2021  TUM School of Engineering and Design
2023  YOUR start here at TUM
TUM Facts and Figures

(statistics 2022)

8 Schools and Departments

18 Nobel Prize Laureates

8 Humboldt Professorships

643 Professors

9,500 Graduates in 2021/22

>1,000 Research Agreements p.a.

176 ERC Grants (since 2008)
TUM Facts and Figures

(statistics 2022)

105 Tenure Track Professorships
36% Female Students
41% International Students
11,758 Staff Members
86,153 Active Alumni
7,453 Researchers
81 TUM Emeriti of Excellence

Technical University of Munich | 2023-10-09
duddeck@tum.de
Growth Path Student Enrollment

- More than 20,800 international students
- 168 International Appointments of Professors (2021/22)
Academic Rankings

QS World University Rankings 2022
No. 1 in Germany
No. 49 in the world

THE World University Rankings 2022
No. 1 in Germany
No. 30 in the world

Shanghai World University Ranking 2022
No. 1 in Germany
No. 56 in the world
18 Nobel Prize Laureates

TUM scientists and alumni have received the Nobel Prize in four fields:

• Chemistry,
• Literature,
• Medicine, and
• Physics.

Prof. Robert Huber
Nobel Prize 1988 / Chemistry
For the determination of the 3D structure of a photosynthetic reaction center
24 Leibniz Prize Laureates

(Deutsche Forschungsgemeinschaft DFG)

TUM members received the most prestigious award for scientists and scholars at German research institutions 24-times, including 10 distinctions in the last decade alone

Prof. Barbara Wohlmuth
Leibniz Prize (DFG) 2012
For her research achievements in numerical analysis in scientific and engineering computing. A focus of her research is the numerics of partial differential equations, to which she has made key contributions, especially with her theoretical study of mortar domain decomposition methods.
TUM Partners of Excellence

Airbus Group
ALTANA AG
AUDI AG
Bayerischer Bauindustrieverband e. V.
BMW AG
Robert Bosch GmbH
Busch Vacuum
Clariant International AG
Dräxlmaier Group
Evonik Industries AG
Google
Herrenknecht AG
HUAWEI
Infineon Technologies AG
Linde AG
MAN SE
Nestlé AG
Rohde & Schwarz GmbH & Co. KG
RWE Group
SAP SE
SGL CARBON SE
Siemens AG
TRUMPF GmbH + Co. KG
TÜV SÜD AG
vbw – Vereinigung der Bayerischen Wirtschaft e. V.
Volkswagen AG
Wacker Chemie AG
TUM Local Network

Academic Network

Industry Network

Start-up Network

TUM Joint Appointments: 51

Technical University of Munich | 2023-10-09
duddeck@tum.de
TUM Global

150+ partner universities worldwide

350+ Erasmus partnerships across Europe
TUM Locations

Six large sites in Bavaria and one in Baden-Wuerttemberg:

• Munich
• Garching
• Freising-Weihenstephan
• Ottobrunn
• Straubing
• Raitenhaslach
• Heilbronn
TUM Campus
Downtown Munich

- TUM School of Computation, Information and Technology
- TUM School of Engineering & Design
- TUM School of Management
- TUM School of Social Sciences & Technology
- Hochschule für Politik München
TUM Campus Garching

- TUM School of Natural Sciences
- TUM School of Computation, Information and Technology
- TUM School of Engineering & Design
TUM Campus Heilbronn

- TUM School of Management
TUM Campus Straubing

- Biotechnology
- Sustainability
TUM Campus Freising / Weihenstephan

- TUM School of Life Sciences
TUM Science & Study Center Raitenhaslach

- Former monastery in Raitenhaslach in the Southeast of Bavaria
- Full service, year-round conference facility
TUM Innovative University Structure
Integrative Research Institutes (IRI)

- Munich Institute of Robotics and Machine Intelligence (MIRMI)
- Munich Data Science Institute (MDSI)
- Munich Institute of Integrated Materials, Energy and Process Engineering (MEP)
- Munich Institute of Biomedical Engineering (MIBE)
TUM Master‘s Programs (105 in 2023)

Master (incomplete)
Aerospace
Automotive Engineering
Bioinformatics
Biomedical Engineering & Medical Physics
Civil Engineering
Computational Mechanics (CoMe)
Computational Science and Engineering (CSE)
Data Engineering & Analytics
Ecological Engineering
Electrical Engineering & Information Technology
Energy & Process Engineering
Environmental Engineering
Ergonomics - Human Factors Engineering
ESPACE Earth Oriented Space Sci. & Techn.
Informatics / Games Engineering

Materials Science & Engineering
Mathematics in Data Science
Mathematics in Science and Engineering
Mechanical Engineering
Mechatronics, Robotics & Biomechanical Engineering
Medical Engineering & Assistance Systems
Physics (Applied and Engineering Physics)
Power Engineering
Quantum Science & Technology
Rail, Transport & Logistics
Research on Teaching and Learning
Responsibility in Science, Engineering & Technology
Risk and Safety
Robotics, Cognition, Intelligence
Science and Technology of Materials
Software Engineering
Sustainable Management and Technology
M.Sc. Computational Mechanics (COME)

• The M.Sc. *Computational Mechanics* was founded in 2000

• It aims for educating experts for industry and academia in the field of computational methods in mechanics for all areas of engineering

http://www.come.tum.de
M.Sc. Computational Mechanics (COME)

Lectures are offered at the central campus.

Main chairs involved are:

- Structural Mechanics, Prof. Gerhard MÜLLER
- Structural Analysis, Prof. Kai-Uwe BLETZINGER
- Computation in Engineering, Prof. André BORRMANN / Stefan KOLLMANNSBERGER
- Hydromechanics, Prof. Michael MANHART
- Computational Solid Mechanics, Prof. Fabian DUDDECK
# M.Sc. Computational Mechanics (COME)

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3</th>
<th>Semester 4</th>
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<tbody>
<tr>
<td>Advanced Fluid Mechanics (6 ECTS)</td>
<td>Electives Computation (12 ECTS)</td>
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<tr>
<td>Finite Element Methods 1 (6 ECTS)</td>
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<tr>
<td>Computational Material Modeling 1 (6 ECTS)</td>
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<tr>
<td>Computation in Engineering 1 (6 ECTS)</td>
<td>Elective modules of various competence fields (17 + 10 ECTS)</td>
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M.Sc. Computational Mechanics (COME)

2-years program (120 ECTS credits)
- 36 ECTS compulsory courses
- 24 ECTS core elective courses
- 27 ECTS elective courses
- 3 ECTS general education (language)
- 30 ECTS master's thesis

- Additional qualification during your COME studies (optional)
  BGCE - Bavarian Graduate School of Computational Engineering

Compulsory courses

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<tr>
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<tr>
<td>Software Lab</td>
<td>Project with focus on one of the specialisations (6 ECTS)</td>
<td>Master Thesis (30 ECTS)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Fluids</td>
<td>Solids &amp; Structures</td>
</tr>
<tr>
<td>TOTAL: 6/120 ECTS</td>
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Compulsory Modules
Computation in Engineering 1

CONTENT

• Object oriented modeling and programming (C++)
• Data structures, classes, etc.
• Sets, relations, and graphs
• Geometrical modeling
• Direct and indirect representations
• Space trees (octrees etc.)
• Curve representations
• Approximation methods
• Implementation schemes

Quadtree for discretisation of a 2D region.

Stefanie Schraufstetter, André Borrmann, Ernst Rank
Compulsory Modules
Advanced Fluid Mechanics

CONTENT

• Continuum hypothesis, kinematics
• Transport equation, equation of motion
• Navier-Stokes equations
• Fundamentals of fluid mechanics
• Scaling laws, Dimensional analysis
• Advection and diffusion
• Boundary layer theory
• Flow instabilities
• Introduction to turbulent flows
Compulsory Modules
Finite Element Methods 1

CONTENT (FEM1 – Part 1)
• Direct Stiffness Method, Variational Formulation
• Beam, Plane Stress, Plate Elements
• Convergence, Locking and FE Technology
• Implementation etc.

CONTENT (FEMSV – Part 2)
• Modelling, Simulation, and Validation (2D / 3D)
• Introduction to an FE software (ANSYS)
• Applications (elasticity, plasticity, heat transfer)
Compulsory Modules
Computational Material Mechanics 1

CONTENT (Basic Materials – Part 1 “mechanics”)
• Elasticity
• Plasticity
• Visco-elasticity
• Visco-plasticity

CONTENT (Composites – Part 2 “materials”)
• Composites, Fiber-reinforced polymers
• Honeycombs, Foams, Biomaterials (bones)
Compulsory Modules
Continuum Mechanics

CONTENT
- Introduction into tensor analysis
- Description of stress states in arbitrary, curvilinear coordinates
- Lagrangian description of strain states
- Conservation of energy
- Conservation of mass
- Constitutive relations
- General treatment of continuum mechanical knowledge in order to solve non-linear problems

\[ \tau^{im} \parallel_i + Q^m - \rho b^m = 0 \]
Compulsory Modules
Software Lab (2\textsuperscript{nd} / 3\textsuperscript{rd} Semester)

CONTENT

• Group work on software development.
• Engineering problems from different application fields.
• Collaboration with industry and academia
The Bavarian Graduate School of Computational Engineering (BGCE) is an association of three Master programs:

1. **Computational Engineering (CE)** at the Friedrich-Alexander-Universität Erlangen-Nürnberg,
2. **Computational Mechanics (COME)**, and
3. **Computational Science and Engineering (CSE)** at the Technische Universität München.

- “Elite” degree program for our best MSc students
- Additional exclusive course offers and training
- Intensive interaction with research staff
- Additional certificate

http://www.bgce.de/
Thanks for joining us – Have fun and success …