

DARTS workshop

TU Delft,
7-8 March, 2023

D. Voskov

 TU Delft



Delft University of Technology

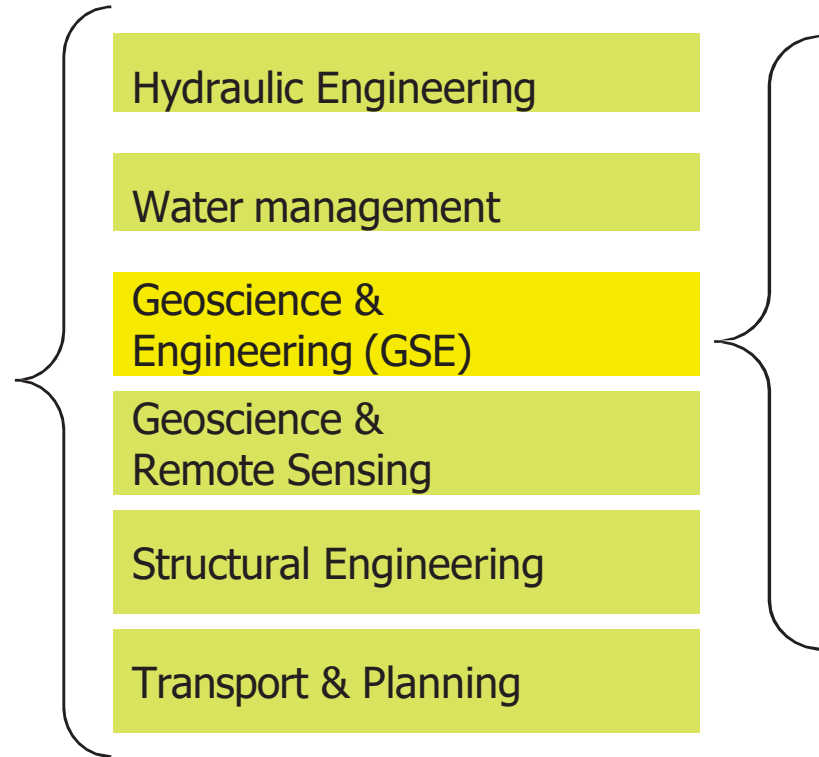
founded 1842
25,000 students
4000 scientific staff
~300 PhD/yr
8 faculties



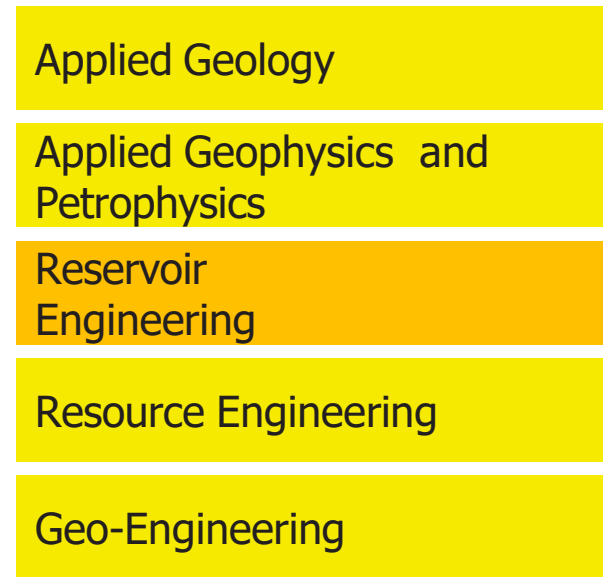
Where are we?

- Aerospace Engineering
- Applied Sciences
- Architecture
- Civil Engineering & Geosciences (CEG)
- Electrical Eng., Math. & Comp. Sci.
- Industrial Design Engineering
- Mech., Maritime and Materials Eng.
- Technology, Policy & Management

TU Delft Faculties



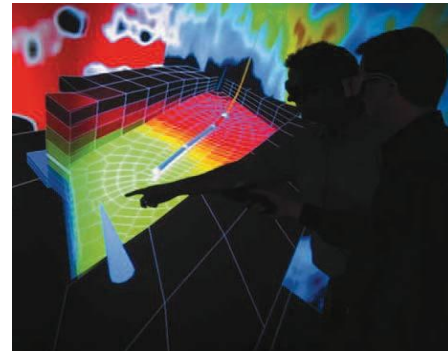
CEG Departments



GSE Sections

Geoscience & Engineering

- Established in 1862 as a Mining Engineering Faculty
- Mining Eng. → Mining & Petroleum Eng. → Applied Earth Sciences → Geotechnology → Geoscience & Engineering
- Now: part of Faculty of Civil Engineering and Geosciences, with 4 civil engineering and 2 geodepartments
- Total staff ~200 (~ 150 FTE):
 - 8 full profs, 17 associate profs, 16 assistant profs,
 - ~30 scientific/teaching staff/post-docs,
 - ~95 Ph.D. students, 20 lab & admin staff

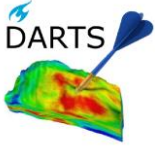


Education, BSc, MSc & PhD programs

mainly Dutch	60% Dutch, 40% international	80% international	
<p>BSc Applied Earth Sciences</p> <p>Broad program</p> <p>In English as of September 2014</p>	<p>MSc Applied Geophysics Jointly with ETH and RWTH</p>	<p>PhD Program</p> <p>Research School</p> <p>Center for Technical Geosciences (CTG)</p>	
	<p>MSc Geoscience and Petroleum Engineering</p>		<p>Reservoir Geology</p>
			<p>Reservoir Engineering</p>
	<p>MSc Resource Engineering EMC (Helsinki, RWTH, Exeter)</p>		
	<p>MSc Geo Engineering Jointly with Civil Engineering</p>		
	<p>MSc Geosc. and Remote Sensing Jointly with Civil Engineering</p>		
< 5% leaves	95% leaves to industry, 5% to PhD	80% to industry	

Geo-Energy Engineering MSc track

- Started in September 2019 and **replaced** Petroleum Engineering and Geosciences track
- Main focus: effective combination of advanced approaches for monitoring, forward modeling, optimization and data assimilation for **energy-related** engineering applications
- Final MSc project is often performed in close collaboration with affiliate companies for applications of **practical** interest
- Include research collaboration with multiple academic partners in TU Delft and world-wide



Delft Advance Research Terra Simulator

Delft: we belong to the Civil Engineering and Geoscience (CEG) Department. The development team is directly linked to the new GeoEnergy program, which connects Geology, Geophysics, and Petroleum Engineering sections of the department.

Advanced: the simulation framework is based on the recently proposed Operator-Based Linearization (OBL) approach, which helps to decouple the complex nonlinear physics and advanced unstructured discretization from the core simulation engine.

Research: the development team includes five PhD students from the CEG department and multiple MSc students working on their thesis project on the DARTS platform.

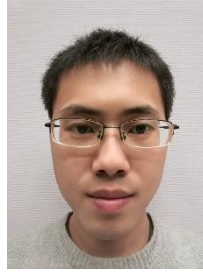
Terra: the developed framework is utilized for forward and inverse problems in petroleum engineering, geothermal applications, subsurface storage, and subsurface integrity.

Simulator: the main simulation kernel is implemented on multi-core CPU and many-core GPU architectures. The advanced multiscale nonlinear formulation improves the performance of forward and inverse models. Additional effort is invested in physics-based proxy models for complex subsurface processes, including multiphase multicomponent flow.

Development team



Mark Khait:
original developer
of DARTS
framework



Yang Wang:
main
geothermal
capabilities



Xiaocong Lyu:
main CO2
sequestration
capabilities



Stephan de Hoop:
fractures, faults
and chemical
reactions



**Kiarash Mansour
Pour:** multi-
segmented well
and ML



Xiaoming Tian:
history matching
and adjoint
gradients



Aleks Novikov:
discretization,
geomechanics,
induced seismicity



Ilshat Saifullin:
open-DARTS
support, thermo-
geomechanics



**Gabriel Serrao
Seabra:** history
matching, proxy
modelling



Michiel Wapperom:
advanced
thermodynamics
and chemistry



Yuan Chen:
geothermal
modelling,
technology and UQ

Time for Questions and Answers

