Track

Solid and Fluid Mechanics

MSc Programme

Mechanical Engineering

Faculty of Mechanical, Maritime and Materials Engineering (3mE)

The design, modelling and control of many structures and systems rely on solid or fluid mechanics. In cases of fluid-structure interaction both solid and fluid mechanics are needed, such as in (car) spoilers, or (windmill or insect) wings, bridges, boat hulls, etc. Facilitated by rapid developments in computer and information technology, we can nowadays run numerical simulation and optimisation models that were unaffordable one or two decades ago. For these reasons, computational mechanics and fluid dynamics are among the keystones of the engineering disciplines. Obviously, new theories and models require rigorous experimental validation, which is only possible through equally advancing diagnostic tools such as dynamic simulators, camera-based measurement systems and/or fast data acquisition systems.

A matter of solid facts and fluid concepts

The Solid and Fluid Mechanics track covers the mechanisms and principles of solid and fluid mechanics and their underlying equations. It provides students with a foundation for experimental, numerical and analytical techniques to investigate both fundamental problems and practical applications in Mechanical Engineering.

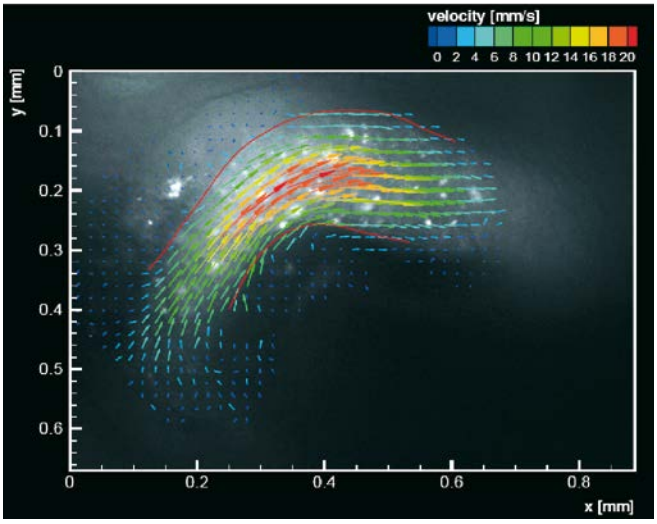
Master's programme

The SFM-programme is organised on the basis of a joint core curriculum and three specialisations. The core curriculum consists of seven compulsory courses (about 28 EC) in the fundamentals of solid and fluid mechanics. For each of these specialisations there is a range of courses tailored to their choice of specialisation. In addition to courses, students must complete an internship of 15 EC, which is recommended especially to do at a university abroad for Dutch students; or somewhere else in the Netherlands for Non-European students. MSc theses are related either to research topics currently being addressed by one of the participating groups or to subjects in which students have a personal interest. There are also plenty opportunities to prepare a thesis in collaboration with firms like Philips, Shell, Tata, ASML, BMW or smaller high-tech companies.

Specialisations

Fluid Mechanics (FM)

The Fluid Mechanics specialisation provides training in the fundamentals of fluid flow. Particular attention is paid to turbulence and multi-phase flow, since these are relevant to many industrial and environmental applications. Much emphasis is placed on computational fluid dynamics (CFD) and its use in solving various practical problems. The Fluid Mechanics group also carries out extensive research on new developments in the application of numerical tools to fluid mechanics, particularly with respect to the simulation of turbulence. In fluid mechanics we cannot do without experiments. For this reason, most of the numerical work is combined with experimental research emphasising the use of new measuring techniques. Consequently, the student is trained in all aspects of modern fluid mechanics in both classroom and research environments.

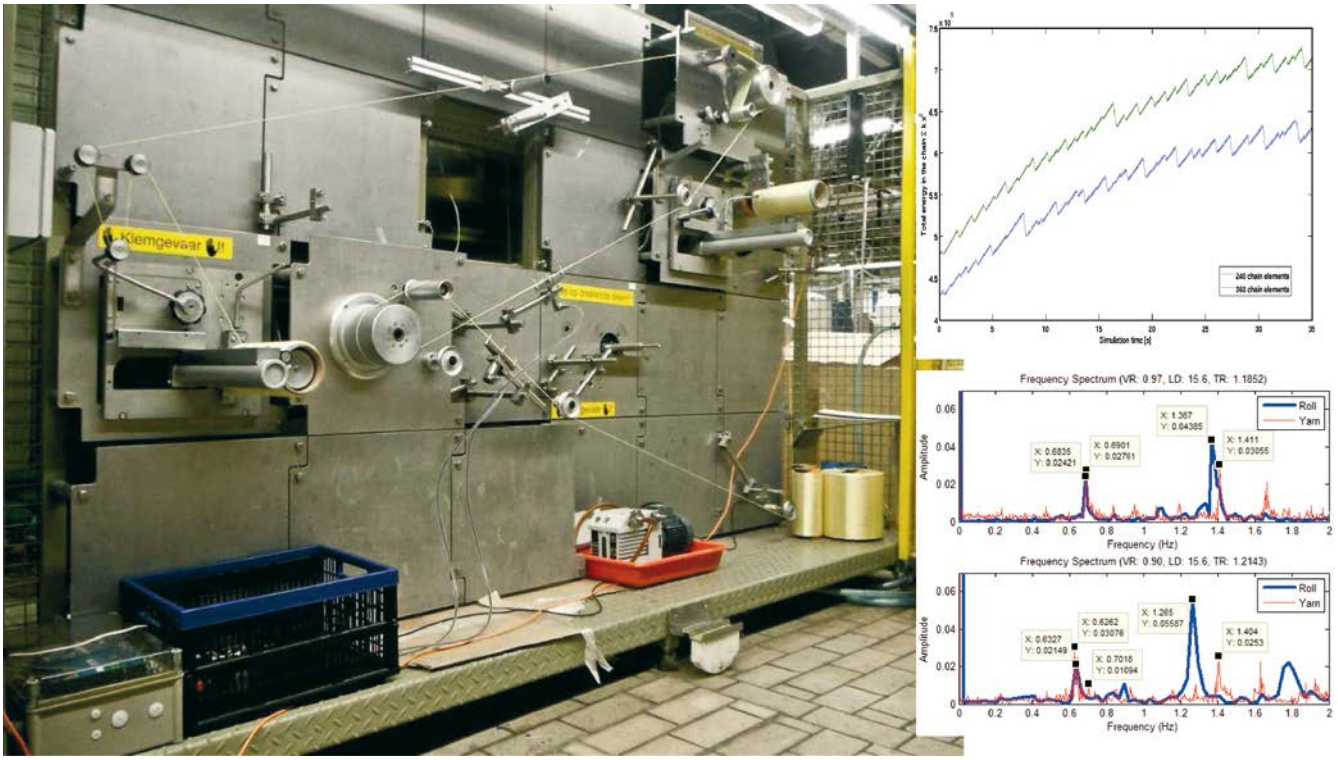


Engineering Dynamics (ED)

Central to the research and teaching of the Engineering Dynamics group is the dynamic behaviour of structures and mechanisms. Students learn the fundamentals of structural vibrations and multibody dynamics, and to use the basic tools needed to handle such problems. Structural dynamics and its coupling with fluid or electromagnetic fields have applications in very many domains, including machine design, biomechanics, mechatronics and aerospace. Education and research in Engineering Dynamics involve computer simulations as well as experimental testing and the measurement of dynamic properties in the laboratory.

Structural Optimisation & Computational Mechanics (SO)

Recent developments in computer technology have opened up a new potential for automated design and optimisation. This requires a solid understanding and knowledge of computational mechanics, as well as optimisation. Other disciplines are nearly always involved as well: production, electrical engineering, material sciences and so on. The MSc specialisation in Structural Optimisation and Computational Mechanics includes lectures on the fundamentals of mechanics, numerical modelling and optimisation, whilst the research programme currently covers composite structures, micro-electromechanical systems (MEMS) and biomedical applications.



Curriculum Solid and Fluid Mechanics

First year	
1st semester	2nd semester
Advanced Fluid Dynamics (6 EC)	Computational Fluid Dynamics (3 EC)
Engineering Mechanics Fundamentals (4 EC)	Computational Methods in Non-linear Solid Mechanics (3 EC)
Numerical Analysis C-II (6 EC)	Fluid-Structure interaction (4 EC)
Microfluidics (3 EC)	Turbulence (6 EC)
Gas Dynamics (3 EC)	Applied Multiphase Flows (6)
Numerical Methods Maritime Technology (2.5 EC)	Flow Measurement Techniques (3 EC)
Race Car Aerodynamics (3 EC)	Biological Fluid Mechanics (3 EC)
Engineering Dynamics (4 EC)	Experimental Dynamics (3 EC)
Mechanical Analysis for Engineering (4 EC)	Non-linear vibrations (3 EC)
	Numerical Methods for Dynamics (4 EC)
	Multi Body Dynamics (3 EC)
	Engineering Optimization: concepts and applications (3EC)
	Engineering optimization 2 (3EC)
	Stability of thin-walled structures 1 (4EC)
Second year	
1st semester	2nd semester
Internship (≥ 15 EC)	Master thesis project (45 EC)

FM Specialization ED Specialization SO Specialization

For more information on all courses: www.studyguide.tudelft.nl.

Career prospects

The SFM-programme is an excellent foundation for those aiming at a career in industry or academia. Most students on the Solid & Fluids track find jobs in R&D in both small and large high-tech companies, such as Mapper, Akzo-Nobel, Stork, ASML, TNO or Deltares. More than half of the students choose to proceed first as a Ph.D.-student; in Delft or elsewhere, after which they are especially attracted by the larger multinational companies, such as Shell, Philips, BMW, TNO or Deltares.

My path from the Solid and Fluid Mechanics MSc degree to a PhD position

After obtaining my bachelor in mechanical engineering at the TU, I continued my study with the master-track Solid and Fluid Mechanics. In the second year of the program I went to Switzerland for a 5-month internship at ETH-Zürich. Here I both developed skills as a researcher and gained personal experience living in a foreign city. My graduation project in Delft was a result of cooperation between two Mechanical Engineering sections; Materials Engineering and Fluid Mechanics.
It consisted of a nice mixture of practical engineering and more fundamental scientific research. The combination of mostly experimental research and some numerical work eventually led to my first very own publication in a scientific paper (the one in my hand on the picture). The joy in performing research and the pleasant ambiance at the laboratory directed me towards beginning a promotion-traject at the group of Aero- and Hydrodynamics on flow phenomena in Liquefied Natural Gas tubing (presented on the poster I'm standing in front of).

Marieke
(The Netherlands)

Admissions requirements

Graduates with a Bachelor's degree from a Dutch University of Applied Sciences (HBO)

Applicants with a degree in Mechanical Engineering are eligible for admission following completion of a bridging course.

Dutch university graduates

Students with a BSc in Mechanical Engineering Mechanical or Aerospace engineering are eligible for admission. Other applicants may be admitted but may be required to enrol in a bridging programme.

International applicants

Applicants from non-Dutch universities should meet the same requirements as graduates from Dutch universities, as well as TU Delft's general admission requirements and will be evaluated on an individual basis.

Example of graduation project

As an example. The Japanese-Dutch Teijin-Aramid company produces the very strong Aramid yarn, as it is used in, among others, sails, car tyres or bullet-proof clothing. In the R&D laboratory in Arnhem the process parameters are optimised for different kinds of yarn products. This example (left) shows a small test bank. During the spinning process (studied by a PhD-student in Fluid Mechanics), the polymerisation reaction takes place. After this the fibres are strained and heat-treated on the rotating hot drums increasing the E-modulus of the yarn. A theoretical model (top right) predicts the stick-slip behaviour of the yarn running over the drum during a transient (done by a student in Computational Mechanics). A laser-Doppler anemometer is used to measure the yarn speed vs time; based on the power spectrum of the speed the same stick-slip behaviour is retrieved (done as internship by a student in Engineering Dynamics).

For further information

Please visit the webpage for all details, complete requirements, deadlines and contact information: www.3me.tudelft.nl

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