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Swiss Federal Institute of Technology Zurich

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Course list "Fluid Science and Engineering"

Background

Fluid-dynamic phenomena, devices and processes play an important role in many areas of modern life. Examples can be found across the complete spectrum of scales - from very large-scale phenomena (e.g. climate and weather prediction, environmental flow modelling) to the microscopic domain (flows in micro-channels, nano-technology), and from problems with a predominantly scientific motivation (astrophysical flows, flow instability and turbulence) to design challenges in engineering devices (gas turbines, vehicle aerodynamics, hydraulic systems, etc.). In many circumstances, the boundaries and distinctions are fluent: Applied problems can often be traced to fundamental flow problems (e.g. drag reduction of internal and external flows), and an improved understanding of the basics does often lead directly to better engineering designs.
Thus, an advanced education with emphasis on fluid dynamics represents an excellent starting point for a later career in engineering. The acquired knowledge can be applied in numerous professional environments, providing competence of significant value to a wide range of future employers.

Study program

Education at IFD places the emphasis on basic phenomena and techniques, reaching well beyond the short-term demands created in a fast-changing market for engineering products. In particular, we offer solid education in experimental and computational methods that provides thorough understanding of the underlying principles and skills in their application, extending far beyond the mere handling of user interfaces of prefabricated tools.
Besides the industrial internship, a direct connection with the practical world of engineering is created by several other means. Some classes with a more applied character are taught by engineering professionals from industry. Thesis topics for the semester project and the Master thesis are sometimes offered in cooperation with external companies and universities. Work can be performed utilizing either IFD's considerable in-house resources (wind- and water tunnels, diagnostics hardware, extensive computer infrastructure) or at the customers' premises in Switzerland and abroad. Regular talks on current research topics by invited guests (Colloquium for

Thermo- and Fluid Dynamics, ERCOFTAC visitors program) provide additional insights into modern developments in the field of fluid dynamics. Finally, Master's students are integrated into the concurrent research environment of the Institute, interacting with doctoral students working on both experimental and computational thesis projects.
The recommended study program of this profile is summarized in the following table.

Strongly recommended core courses (6 x 4 = 24 ECTS)

Course ID	Course Title	Lecturer	HS/FS	ECTS	Schedule
151-0105-00	Imaging in Fluid Dynamics	Coletti	HS	4	Tue 10-13
151-0109-00	Turbulent Flows	Jenny	HS	4	Thu 8-10 & 13-14
151-0709-00	Stochastic Methods for Engineers and Natural Scientists	Meyer-Massetti	HS	4	Wed 10-14
151-0110-00	Compressible Flows	Kubik	FS	4	Wed 13-14, Thu 8-10
151-0212-00	Advanced CFD Methods	Jenny	FS	4	Mon 11-12 & 15-17
151-1906-00	Multiphase Flow	Coletti	FS	4	Mon 12-13, Tue 12-14

Recommended core courses (select at least 12 ECTS) or multidisciplinary courses (select at least 6 ECTS)

Course ID	Course Title	Lecturer	HS/FS	ECTS	Schedule
151-0125-00	Hydrodynamics and Cavitation	Supponen	HS	4	Mon 10-13
151-0215-00	Fundamentals of Acoustics	Noiray, Van Damme	HS	4	Tue 9-12
151-0216-00	Wind Energy	Chokani	HS	4	Thu 14-17
151-0293-00	Combustion and Reactive Processes in Energy and Materials Technology	Noiray, Ernst, Frouzakis	HS	4	Thu 10-12, Mon 17-18
151-0917-00	Mass Transfer	Pratsinis et al.	HS	4	Tue 14-16, Wed 10-12
151-1116-00	Introduction to Aircraft & Car Aerodynamics	Immer, Schröder	HS	4	Thu 16-19
402-0861-00	Statistical Physics	Demler	HS	10	Tue 14-18, Wed 12-16
151-0232-00	Engineering Acoustics II	Noiray et al.	FS	4	Tue 9-12
151-0252-00	Gasturbines: Cycles and Combustion Systems	Jansohn	FS	4	Mon 14-17
151-0980-00	Biofluiddynamics	Obrist, Jenny	FS	4	Fri 10-13
151-1115-00	Aircraft Aerodynamics and Flight Mechanics	Immer	FS	4	Thu 16-19
401-3652-00	Numerical Methods for Hyperbolic Partial Differential Equations	Lanthaler	FS	10	Mon 14-16, Tue 16-18
651-4001-02	Advanced Geophysical Fluid Dynamics	Noir, Burmann	FS	2	Tue 14-16
701-1270-00	High Performance Computing for Weather and Climate	Fuhrer	FS	3	40 hours summer break

Further courses suggested by MSc tutors of IFD

Course ID	Course Title	Lecturer	HS/FS	ECTS	Schedule
101-0267-01	Numerical Hydraulics	Holzner	HS	3	Mon 14-16
151-0213-00	Fluid Dynamics with the Lattice Boltzmann Method	Karlin	HS	4	Wed 10-13
151-0251-00	Principles, Efficiency Optimization and Future Applications of IC Engine Based Powertrains	Wright, Soltic	HS	4	Tue 10-13
151-0509-00	Acoustics in Fluid Media: From Robotics to Additive Manufacturing	Ahmed	HS	4	Wed 16-19
151-0524-00	Continuum Mechanics I	Ehret	HS	4	Fri 8-10, Wed 12-13
151-0532-00	Nonlinear Dynamics and Chaos I	Haller	HS	4	Wed 10-12, Tue 16-18
701-0479-00	Umwelt-Fluiddynamik	Wernli, Röthlisberger	HS	3	Fri 14-16
151-0170-00	Computational Multiphase Thermal Fluid Dynamics	Coletti, Dehbi, Sato	FS	4	Tue 14-17
151-0530-00	Nonlinear Dynamics and Chaos II	Haller	FS	4	Tue 16-18, Wed 10-12
151-1906-00	Multiphase Flow	Coletti	FS	4	Mon 12-13, Tue 12-14
401-0674-00	Numerical Methods for PDEs	Hiptmair	FS	8	Mon 16-18, Fri 10-12
701-1216-00	Weather and Climate Models	Schär et al.	FS	4	Thu 14-18

Please note that the lists of courses will be adapted to the needs and preferences of the individual student to create his/her Master Tutor agreement.

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