MASTER OF SCIENCE IN ENGINEERING

Special Course (SpC) on MSE Moodle Platform

Title: Computational science and engineering applied to air conditioning systems

Abbrev: EVA_DSH

Credits	3
Responsible UAS	ZHAW
Responsible MRU	IEFE
Course responsible	Frank Tillenkamp: till@zhaw.ch, Christian Ghiaus: christian.ghiaus@insa-lyon.fr
Examination	33.3% Written 2h, w/o documents on 29/05/2020 33.3% Written report of group work due on 27/05/2020 33.3% Oral presentation of group work on 29/05/2020
Start date	18/04/2022
End date	27/05/2020
Location	Winterthur
Course type	Face to face lectures and tutorials (18/04/2022 – 20/04/2022) 20 h (22 %) Tutorial and accompanied mini-project (20/04/2022 – 22/04/2022) 20 h (22 %) Autonomous group project (22/04/2022 – 25/05/2022) 50 h (56 %) Total 90 h (100 %)
Language	English
Short Content	Air conditioning increases productivity and comfort but it is responsible for about 15 % of total energy consumption. The course develops competences for practical optimization of air conditioning systems coupled to buildings by using computational thinking and implementation.
Content and Goals	**Face to face** **Lectures** Module 1: Psychrometrics (numerical calculation of moist air properties, typical transformations). Thermal comfort. Module 2: Modelling of typical elements of air conditioning systems Module 3: Modelling and simulation of air conditioning systems coupled to buildings

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	Tutorials Tutorial 1: Calculation of moist air properties and matrix formulation of models Tutorial 2: Numerical modelling of air conditioning systems Tutorial 3: Coupling air conditioning systems to buildings **Accompanied individual mini-project:** Free-cooling Air mixing and heating Air-mixing, heating, humidification Heat recovery, heating, adiabatic humidification heat recovery and cooling **Autonomous group project:** The students will define their own subject on indoor climate control (temperature and humidity): a building and its air conditioning system will be modelled. On this model, optimisation of design parameters and energy management will be done. Examples of projects: detached house, school, office building, green house, supermarket, research laboratory, restaurant.
Pre-requisites	The course is self-contained. Subjects useful at undergraduate level: linear algebra, thermodynamics, heat transfer, computer programming (MATLAB / Octave or Python).
Literature	All teaching materials are provided as PDF (bibliography, supporting materials and slides for lectures and tutorials). **Bibliography** - G. Strang (2007) Computational Science and Engineering, Wellesley-Cambridge Press, ISBN-10 0-9614088-1-2 - C. Ghiaus (2014) Linear algebra solution to psychometric analysis of air-conditioning systems, Energy vol. 74, pp. 555-566 - ASHRAE Fundamentals, chapters F01 Psychrometrics, F07. Fundamentals of controls, F09 Thermal Comfort, F16 Ventilation and Infiltration, F17 and F18 Heating and Cooling Loads
Special requirements	Before the beginning of the course: Every student needs to have access to MATLAB, Octave and/or Pyhton software. Octave and Python are free and open source. Teaching materials need to be downloaded and saved on each computer.