Date	Research Area	Presenter	Subject	Abstract
January 4, 2019	AGM	Marc Secanell	Annual State of the Lab Address	
January 9, 2019	PEMFC/E Modeling	Ambuj Punia	Progress in Methane thermal cracking	Some preliminary results in gas phase (both experiment and modelling results) will be shown. In addition to this results are shown which confirm that tranfer of gas from reactor to the testing bag does not affect the concentration of gas phase species.Finally soot formation modelling will be presented analytically to give an idea as how we can model soot formation from gas phase to solid phase.
January 16, 2019	Cooling Tower	Lisa Clare	Cooling Tower Experimental Model Update	Current state and near-future work on the physical construction of the experimental model. Results from first pressure drop experiments.
January 23, 2019	PEMFC/E Experiments	Luis Padilla	EIS results for computational model	A summary of the latest experiments and results of EIS and hysteresis for computational model
January 30, 2019	PEMFC/E Modeling	SeongYeop Jung	Comparison of simulation results of sintered Ti in PNM and FCST	Simulation results using reconstructed x-ray image of sintered Ti material will be discussed. Introducing newly scanned Ti micro-CT image
February 6, 2019	PEMFC/E Modeling	Prof. Ramon Costa	Control and Energy Management of PEM Fuel Cell Systems	Proton Exchange Membrane Fuel Cells (PEMFC) are electrochemical devices that convert the chemical energy of hydrogen into electricity through an electrochemical reaction of an hydrogen-containing fuel with oxygen. The result of this reaction is electrical energy, heat (thermal energy) and water, and consequently PEMFC are clean energy generators. Control systems play an important role in PEMFC technology. In this talk, different aspects related with the role of control technology in PEMFC will be described. **Note: the meeting will be from 10AM to 12PM at DICE 10-242**
February 13, 2019	Cooling Tower	Alex Jarauta	Efficient fluid flow solvers in OpenFCST	The new fluid flow solvers based on the Schur complement to solve Stokes flow will be reviewed, as well as future work on solvers for Navier-Stokes equations
February 20, 2019	PEMFC/E Experiments	Clara Kofler	Final presentation	Explaining the viscosity tests and my results, talking about the changes in the tutorial
		Manas Mandal	Understanding the impact of catalyst layer microstructure on losses of inkjet printed PEM electrolyzer	Practice session for candidacy exam
February 27, 2019	PEMFC/E Modeling	Aslan Kosakian	Numerical Analysis of Counter-flow Wet-Cooling Tower using the augmented model	This presentation will cover the basics of the pore-size-distribution-based model for flows in porous media used in OpenFCST. Some new statistical and conceptual details will be discussed in detail.
March 6, 2019	Cooling Tower	Prashanth Karupothula	CFD analysis of multi-component heat and mass transfer in wet cooling tower	This presentation will cover a brief introduction to the numerical modeling of cooling towers. The focus will be on various zones of the tower and the respective models that will be used in the current study. Some preliminary data to support the need for turbulence modeling for the air flow in the tower will be presented.
	PEMFC/E Experiments	Elena Ezquerra	Problematic of informal gold mining in the Peruvian Amazon Basin	Program UTEC-Harvard SEAS, where the general goal was to develop a solution that addresses the problematic of informal gold mining in Madre de Dios Region. We designed a tool for soil nutrient analysis to boost agriculture as an economic alternative to gold mining. The result of this program was a prototype of a device capable of measuring the amount of phosphorus on the soil.
March 13, 2019	PEMFC/E Experiments	Danica Sun	Passive Energy Discharge Characterization and Health Monitoring of a Flywheel Energy Storage System (FESS)	This presentation will briefly introduce the flywheel demonstrator and how measurements are taken to characterize its self discharge behavior. Empirical models are created from experimental data which are then used to quantify losses between zero and 5,000 RPM. Techniques of health monitoring will be also discussed in this presentation, and optical methods are proved to be more feasible.
April 10, 2019	PEMFC/E Experiments	Hao Xu	Experimental Measurement of Mass Transport Parameters of Gas Diffusion Layer and Catalyst Layer in PEM Fuel Cell	Practice session for final exam
May 8, 2019	Cooling Tower	Aditya Kodkani	Numerical Analysis of Counter-flow Wet-Cooling Tower using the augmented model	This presentation will briefly introduce the augmented model to study the thermodynamic properties of the cooling tower. This model is extended to study the rain and spray zones in the cooling tower. Further, I will be discussing the performance of the cooling tower in different ambient conditions.
May 15, 2019	PEMFC/E Experiments	Wei Fei	Experiemental analysis of carbon matrix on mass transport properties	This presentation will cover the characterization of SGL samples with different carbon matrix content, i.e., SEM images, porosity, thickness, in-plane permeability and diffusivity.
May 29, 2019	PEMFC/E Modeling	Michael Moore	Numerical Modelling of Polymer Electrolyte Membrane Water Electrolysis	This presentation will discuss some of the key issues that persist in polymer electrolyte membrane water electrolysis. These issues include minimising hydrogen crossover, understanding mass transport losses, the mechanism of the OER and the degradation of catalyst and PTL. Numerical modelling will be used to attempt to shed light on some of these issues, with the main goal being able to accurately model polarisation curves and EIS data. Then what-if analysis will be used to determine limiting processes and optimise the construction of the cell and its operating conditions.

June 12, 2019	Cooling Tower	Alex Jarauta	A transient Lagrangian model for droplets on substrates with moving contact lines	Multi-phase systems with strong surface tension effects are present in many applications involving liquid droplets. Many of such systems of practical interest are characterized by the continuous interaction of three phases (i.e., gas, liquid, and solid). Modeling the motion of the contact line, which is the gas-liquid-solid interface, is still a challenge from both the physical and numerical modeling points of view. In this work, a novel formulation for the simulation of wetting phenomena based on the particle finite element method (PFEM) is addressed. The model presented here includes a dissipative force term that accounts for friction losses between the liquid and the solid phases. Including this term is paramount to avoid overpredicting contact line velocities in wetting phenomena analysis.
June 19, 2019	PEMFC/E Experiments	Scott Strobakken	Current State of Affairs of Anion Exchange Membrane Water Electrolysis within the ESDLab	An update on the AEMWE test-station design and fabrication, as well as a summary of an ongoing literature review, is to be presented.
June 26, 2019	Cooling Tower	CT group members	Rehearsal for ESDLab - ICT meeting	
July 10, 2019	PEMFC/E Modeling	Vaishnavi Kale	Optimal design of flywheel rotors used for short duration grid energy storage	Practice session for candidacy exam
July 17, 2019	PEMFC/E Experiments	Manas Mandal	Measurement of the Protonic Conductivity of PEM Water Electrolyzer Electrodes	The hydrogen pump technique is used to study the proton-transport resistance of polymer electrolyte membrane water electrolyzer electrodes. Three catalyst coated membranes made with two membranes sandwiched together were prepared with two of them with an intermediate pseudo catalyst layer (PCL) with 35 and 55 %wt. ionomer loadings. The proton-transport resistance was calculated by subtracting the overall resistance of the cell without a PCL from that with a PCL. The effect of the ionomer loading on the PCL proton conductivity was studied. As expected, the proton conductivity increased with increasing ionomer loading. The rate of increase in the proton conductivity with increasing RH of 35 %wt. ionomer loading PCL is higher than that of the 55 %wt. ionomer loading PCL. This might be due to either a higher rate of decreasing tortuosity with increasing RH for the 35 %wt. ionomer loading PCL or to water accumulation in the nanopores of the PCL which contribute in proton conductivity.
July 24, 2019	PEMFC/E Modeling	Ambuj Punia	Supervisory committee presentation	
July 31, 2019	Cooling Tower	Alex Jarauta	A compressible fluid flow model for channels and porous materials	A volume-averaged compressible fluid flow model for mass transport in channels and porous media is presented. Details on the volume-averaging procedure are discussed, as well as the single domain set of governing equations. Results include a benchmark test, validation of the code using in-plane and through-plane experiments, and mass transport in a fuel cell gas channel.
August 14, 2019	PEMFC/E Experiments	Luis Padilla	Experimental testing of separate catalyst layers PEM unitized regenerative fuel cells (URFC)	Aside from the effect on performance from the catalyst synthesis, the actual process of manufacturing the catalyst layers for the electrodes has proved to be an important factor for the further development of URFCs. Looking for a proper methodology for testing these cells, an initial approach of experiments, focusing on separate catalyst layers configuration, will be presented.
August 21, 2019	PEMFC/E Modeling	Elizabeth Gierl	Arduino seminar	Arduino seminar starts at 2 pm
		SeongYeop Jung	Comparison of pore network and continuum model predictions in 3D microstructure	This presentation will breifly introduce two different microstructure modeling methods using binary tomography images and discuss the simulation results and persistent issues.
August 28, 2019	PEMFC/E Modeling	Prashanth Karupothula	CFD analysis of fluid flow in an induced draft cooling tower	Cooling tower is a heat exchanging device which uses ambient air to cool hot process water from industrial plants. The air enters at the bottom of the tower and abruptly changes the direction due to which a stagnation zone is observed in the tower. This, in turn, results in non-uniform distribution of air at the fill inlet which will have adverse effects on the final performance of the tower. In this talk, the governing equations, the domain, the boundary conditions and the fluid flow in the tower will be discussed.
September 4, 2019	PEMFC/E Experiments	Danica Sun	Operating power losses in a flywheel energy storage system	This presentation will briefly discuss the experimental results and transient model established used to quantify the losses during charging and standby modes. An optical method using laser sensor to measure the deformation of the flywheel rotor will also be introduced.
September 9, 2019	PEMFC/E Modeling	Aslan Kosakian	An Open-Source Transient Model for Numerical Characterization of Proton Exchange Membrane Fuel Cells	An overview of the fuel-cell model validation in the literature will be given. The importance of considering multiple experimental data sets coming from different characterization techniques in the process of the model validation will be highlighted. A transient fuel-cell model will be presented that is capable of reproducing the experimental i-V, i-R, and EIS data.
September 16, 2019	PEMFC/E Experiments	Wei Fei	Effect of GDL carbon matrix on its microstructure and on transport and performance for PEMFCs	This presentation will introduce the hypothesis that the carbon matrix content in SGL GDLs will lead to different PEMFC electrochemical performance. In order to validate this hypothesis, porosity, PSD and carbonmatrix content are measured by MIP test; the gas transport properties, i. e., permeability and diffusivity, are measured by diffusion bridge; water cross-over are measured by water balance using RH&T sensor.

September 23, 2019	PEMFC/E Modeling	Tobias Neef	Fluid flow in polymeric multi-channel membranes with anisotropic properties	An overview about the flow phenomena inside the porous structure of an ultrafiltration membrane is presented. They are used for pre-treatment of seawater in desalination plants. New technologies in the field of membrane fabrication allow new types of membranes. My project observed the behaviour of a polymeric multi-channel membrane (invented 2002, first paper in 2005). The project has new insights what happens between the channels during the filtration and backwashing process.
September 30, 2019	PEMFC/E Experiments	Scott Strobakken	Dynamic Light Scattering Analysis of Carbon Based Inks	The theory behind dynamic light scattering (DLS) experiments is to be presented along with a general procedure for analyzing the quality of data obtained from a DLS experiment. Specific cases of acceptable DLS data will be given for carbon and Pt|C inks produced within the ESDLab.
October 7, 2019	PEMFC/E Modeling	Aditya Kodkani	Numerical modeling of heat and mass transfer of a mechanical draft cooling tower	In this presentation, I will be discussing the augmented model and its potential to represent the contribution of heat rejected and mass evaporated in different zones. The developed augmented model is validated against the standard Poppe and Merkel method present in the literature. Further, the model is validated against the field data and the performance of the cooling tower is studied under hot-dry, hot-humid, Cool-dry and Cool-humid conditions.
October 21, 2019	PEMFC/E Experiments	All experimentalists	Fuel cell fabrication and testing tutorial	
November 18, 2019	PEMFC/E Modeling	Vaishnavi Kale	Simultaneous shape, size and speed optimization for maximizing the energy capacity of a flywheel rotor	The simultaneous optimization of the shape, size and speed of a flywheel rotor is presented as a novel approach to improve the energy storage capacity of a flywheel in a grid application. Two commercially manufactured FESS rotors are used as case studies to demonstrate the benefit of using the proposed optimal design process. Some new functionalities implemented in the OpenFCST framework to perform the above studies, such as, 1) iterative remeshing of a parameterized 2D rotor geometry (with error handling) using pyfcst and Gmsh, 2) adaptive mesh refinement during optimization iterations to ensure convergence of a stress constraint and 3) setting up OpenFCST based optimization studies on an HPC cluster, are also briefly discussed during the presentation.
December 2, 2019	PEMFC/E Experiments	Lisa Clare	Rehearsal for the M.Sc. thesis defence	The classic methods of designing and analysing cooling towers are 0D or 1D in their formulation, and neglect the deleterious effects of maldistribution of air and water. In the work presented here, a lab-scale cooling tower has been designed and built, allowing for the experimental measurement of 3D airflow phenomena which have until now only been assessed with CFD. The major design considerations of the experimental model are discussed. Measurements reveal unique features of the internal air flow field, including zones of recirculation, homogenizing elements, and the interaction between airflow disturbances in close proximity. Pressure losses induced by the fill and drift eliminator are measured, and discrepancies relative to the manufacturer's predictions are observed and discussed.
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