



Two Mines Nancy programs for Erasmus students

April 29, 2021

Emmanuel Plaut

- **Mines Nancy** is one of the 11 Graduate Engineering Schools of Université de Lorraine (60 000 students).
- We have an **Erasmus** program Oldenburg ↔ Nancy since 2018.
- **Professors'** mobilities exist since 2015.
- **Students'** mobilities for internships Nancy → Oldenburg exist since 2017.
- Aim of this meeting:
motivate 1-2 **students'** mobilities for studies Oldenburg → Nancy from September 2021 to February 2022 !
- **Erasmus students** do not pay tuition fees and get **Erasmus funding**
→ **2 programs Multiscale Materials** and **Energy & Fluid Mechanics** that may be mixed !



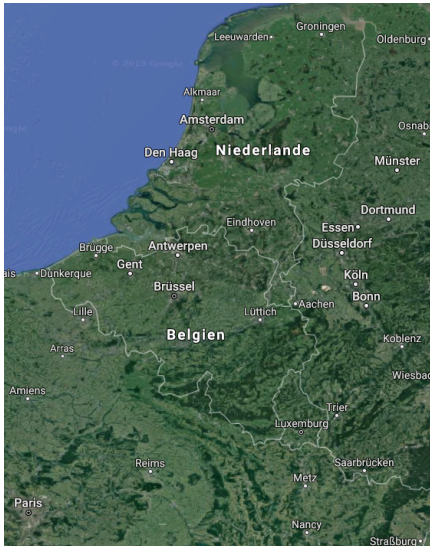
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Plan

- Nancy, Mines Nancy, Erasmus: Geography and History
- Program 1: Multiscale Materials
- Program 2: Energy & Fluid Mechanics
- Conclusion

Nancy ?



Oldenburg



Nancy
=
514 km
9 hours by train

Paris



Nancy = 300 km - 90 minutes by fast train

Nancy

- A bit of History

Created at the beginning of the 19th century,
Nancy became the capital city of the dukes of Lorraine.
From this, it has inherited nice buildings, places and gardens...



Nancy, Mines Nancy - A bit of History

In the XIXth and XXth century, Lorraine was marked by wars, and hosted many soldiers...

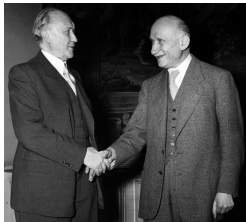


In 1920 the « **École supérieure des mines et de la métallurgie** » was created in the **Université de Nancy**, because the coal and mining industry of Lorraine needed **engineers** and because **future engineers** needed **professors** !



Nancy, Mines Nancy & Erasmus - A bit of History

In the 1950s, Adenauer, Schuman and others reinvented **Europe** (the **ECSC**),
and in 1987 **Europe** invented **Erasmus** !



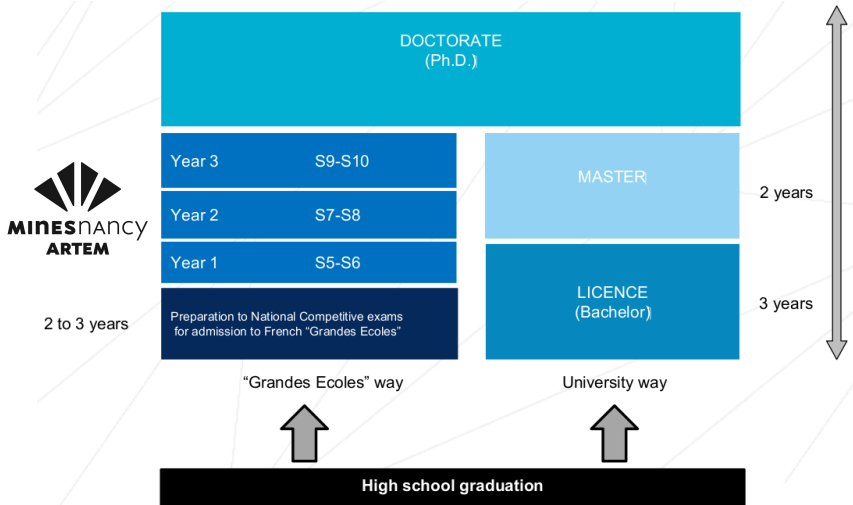
In 1985 the « **École supérieure des mines et de la métallurgie** »
became « **Mines Nancy** »,
and in 2012 it moved into the new « **campus Artem** ».



Mines Nancy: now a general Graduate Engineering School with ~ **500 students** and 5 departments

- **Material Sciences** (→ **Multiscale Materials** program)
- **Energy** (→ **Energy & Fluid Mechanics** program) (❤)
- **Geosciences & Civil Engineering**
- **Applied Mathematics**
- **Computer Sciences**

Graduate Engineering School ?



Our 2 programs **Multiscale Materials** and **Energy & Fluid Mechanics** are at the S9 ((Winter) Semester 9) level = 1st Semester of the Master 2 Year !

We want you !

The *Direction de l'Action Internationale* of **Mines Nancy**
will welcome you and help you !

International week-end



Campus life...



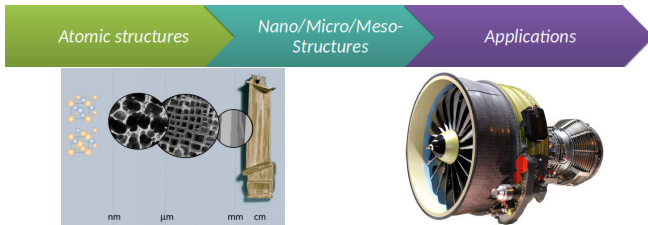
Do you have questions on the general framework ?

Program 1: Multiscale Materials

MM covers the science and engineering necessary to characterize and model the properties of a wide range of **materials** such as **metals** and **alloys**, **polymers**, **ceramics**, **composites**, **biomaterials** and **nanomaterials**.

It highlights the relationships between **material structures** and their mechanical and physical properties and functionalities.

Bridging multiple length-scales, this program addresses fundamental aspects as well as cutting-edge applications in multiple areas.



Program 1: Multiscale Materials 28 ECTS

8 modules in English for 20 ECTS:

- 1 Materials by Design (21 h - 2 EC)
- 2 Materials characterization (21 h - 2 EC)
- 3 Multiscale mechanics (21 h - 2 EC)
- 4 Devices at different length-scales (21 h - 2 EC)
- 5 Modeling at the atomic and molecular scales (21 h - 2 EC)
- 6 From surfaces to coatings (21 h - 2 EC)
- 7 Materials Forming (36 h - 4 EC)
- 8 Superconductors or Biomimicry (36 h - 4 EC)

+ **Research project** in a research lab for 100 h - 8 ECTS !

Program 2: Energy & Fluid Mechanics

Production, conversion and transport of **energy**, in a broad sense, often use **fluid systems** or **loops**.

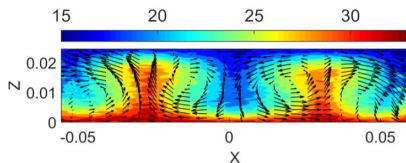
Moreover, the **renewable water** and **wind powers** are in essence '**fluidic**'.

Their simplicity and low environmental impacts

make those **power sources** relevant for the **energy transition**.

EFM covers the science and engineering necessary to model and develop **thermofluid systems** in general.

It also opens on the science and management of '**electric energy**'.



Program 2: **Energy** & **Fluid Mechanics** 24 ECTS

4 modules in English for 8 ECTS:

- 1 **Transition to turbulence in thermoconvection & aerodynamics** (21 h - 2 EC)
- 2 **Turbulence & Wind Energy** (21 h - 2 EC)
- 3 **Open Codes for Fluid Dynamics** (21 h - 2 EC)
- 4 **Electric Energy Management - Integration of renewable energies** (21 h - 2 EC)

+ 2 modules in English from the program **Multiscale Materials** for 8 ECTS :

- 5 Materials Forming** (36 h - 4 EC)
- 6 Superconductors** (36 h - 4 EC)

+ **Research project** in a research lab for 100 h - 8 ECTS !



Program 2: **Energy** & **Fluid Mechanics** 24 ECTS

+ **6 ECTS** pour **francophones** = **30 ECTS**

4 modules in English for 10 ECTS

+ 2 modules in English from the program **Multiscale Materials** for 8 ECTS

+ a **research project** in a research lab for 100 h - 8 ECTS

+ 3 modules en français pour 6 ECTS:

7 Transferts en milieux multiphasiques (21 h - 2 EC)

8 Combustion (21 h - 2 EC)

9 Biomasse énergie (21 h - 2 EC)

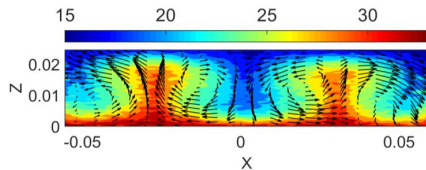


EFM core module 1:

Transition to turbulence in thermoconvection & aerodynamics

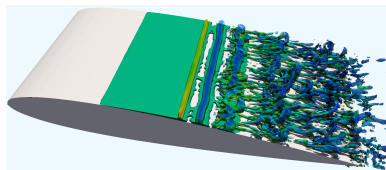
How does a flow goes complex or turbulent as a control parameter changes ?

- Thermoconvection



[Leclerc & Métivier 2018]

- Open shear flows

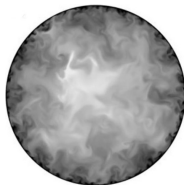


[Tangermann & Klein 2019]

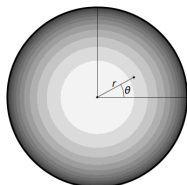
- Weakly nonlinear stability & bifurcation theory.
- ▷ Use **Mathematica** for symbolic and mixed symbolic/numeric computations - spectral method to solve boundary value PDEs.

EFM core module 2: Turbulence & Wind Energy (partnership with Oldenburg !)

- **Turbulence** models for engineering: Reynolds-Averaged Navier-Stokes models.
Idea: do not compute the **instantaneous velocity** but only the **mean velocity**:

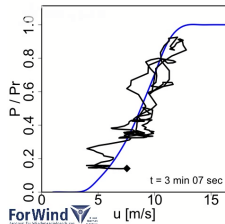


[El Khoury et al. 2013]



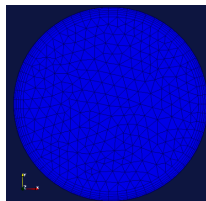
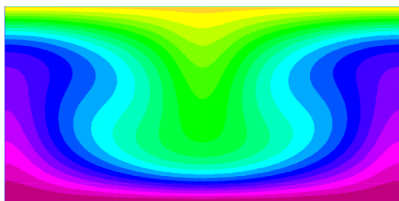
[Gisselbrecht & Plaut 2015]

- **Aerodynamics / Stochastic models for WE**
 - Rotor blade **aerodynamics**
 - **Wind field and turbulence**
 - IEC **power** curve/**production**, stochastic **power** curve
- ▷ Use **Matlab / R** to go through DNS or expe. databases.



EFM core module 3: Open Codes for Fluid Dynamics

- General presentation of CFD simulations.
Review of main numerical methods for CFD.
- ▷ The finite elements code **FREEFEM++** as a tool to solve specific research & development problems.
- ▷ The finite volumes code **OpenFOAM** to introduce parallel computing.
- Applications: **thermoconvection**, **pipe flows of non-newtonian or turbulent fluids**.



EFM core module 4:

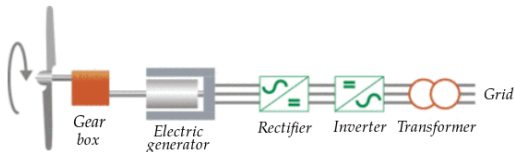
Electric Energy Management - Integration of renewable energies



- **Electrical models** of **photovoltaic** and **wind generators**.
 - **Power electronic converters** used to transfer **energy** from **renewable energy sources** to the **grid** and their associated control.
- ▷ Use **Matlab/Simulink** to simulate **electrical systems**.



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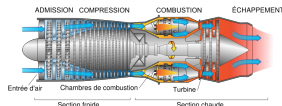
EFM 3 modules de cœur supplémentaires pour francophones : Transferts en milieux multiphasiques

- Modélisation : prises de moyenne, équations moyennées.
- Évaporation et condensation.
- Applications : évaporateur et condenseur.



Combustion

- **Thermodynamique**, **thermochimie** et **aérothermochimie** de la **combustion**.
- Applications : chaudières, moteurs thermiques, turbines à gaz.



Biomasse énergie

- Production de **biogaz** et **biocarburants**.
- **Combustion** du bois, **gazéification** et **pyrolyse**.



Conclusion and procedure - Deadlines

Mines Nancy offers 2 programs for **Master students**,

- **Multiscale Materials** 28 ECTS,
- **Energy & Fluid Mechanics** 24 ECTS (+ 6 ECTS pour les **francophones**),

which run in the Semester 9 from September 2021 to February 2022.

You may add 2 language courses, e.g. English, French as a Foreign language, 2 ECTS each !

Interested

- mail **me** emmanuel.plaut@univ-lorraine.fr, at the latest on **Monday May 3, 2021 !**
 - follow the procedure <https://uol.de/erasmus-bewerbung> ; submit the online application including the signature of the **departmental coordinator Prof. Peinke** (joachim.peinke@uol.de) to **Andreas Männle** (andreas.maennle@uol.de) from the **International Office**, at the latest on **Wednesday May 5, 2021 !**
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This presentation is available on

<http://energie.mines-nancy.univ-lorraine.fr/erasmus/pres.pdf>

Questions ?