MSE-443(b)  Modelling problem solving, computing and visualisation II

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Science et génie des matériaux</td>
<td>MA2, MA4</td>
<td>Opt.</td>
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<table>
<thead>
<tr>
<th>Language</th>
<th>Credits</th>
<th>Session</th>
<th>Semester</th>
<th>Exam</th>
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<tbody>
<tr>
<td>English</td>
<td>3</td>
<td>Summer</td>
<td>Spring</td>
<td>During the semester</td>
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<tr>
<th>Workload</th>
<th>Weeks</th>
<th>Hours</th>
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<tr>
<td>90h</td>
<td>14</td>
<td>3 weekly</td>
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<tr>
<th>Lecture</th>
<th>2 weekly</th>
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<tbody>
<tr>
<td>Practical work</td>
<td>1 weekly</td>
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<tr>
<td>Number of positions</td>
<td></td>
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Remarque
Some of this course will be given via video conference and will be simultaneously taught with an MIT subject. Pas donné en 2019-20

Summary
Covers development and design of models for materials processes and structure-property relations. Emphasizes techniques for solving equations from models or simulating and visualizing behavior. Topics include symmetry, structure, thermodynamics, solid state physics, mechanics, and data analysis.

Content
- Development of Models, Solutions, and Visualization
- Symmetry and Structure of Materials
- Elasticity and Fracture Mechanics
- Monte Carlo Methods
- Molecular Dynamics Methods
- Data Analysis
- Solid State Physics

Keywords
Materials science, modeling, visualization, simulations

Learning Prerequisites
Required courses
MSE 443(a)

Important concepts to start the course
At least intermediate level programming with Mathematica. At least intermediate level knowledge of core materials science topics, calculus, linear algebra.

Learning Outcomes
By the end of the course, the student must be able to:
• Analyze models of materials science phenomena
• Visualize results of solutions and simulations
• Model materials science phenomena

Transversal skills
• Assess one's own level of skill acquisition, and plan their on-going learning goals.
• Demonstrate a capacity for creativity.
• Demonstrate the capacity for critical thinking

Teaching methods
Flipped classroom with programming exercises, extemporaneous lectures.

Expected student activities
Students will complete exercises and asked to demonstrate their work to the rest of the class.
Students will need to work on exercises outside of class and present their work to the rest of the class.
Students will develop three projects with formal demonstrations to the class and instructors.

Assessment methods
Grades will be given on project demonstrations and examples of programming in class.

Supervision
Office hours Yes

Resources
Bibliography
Mathematica documentation.
Electronic Materials from Instructor’s website

Ressources en bibliothèque
• Mathematica Demystified / Hoste
• Computing with Mathematica / Hoeft
• The Mathematica guidebook : for programming / Trott