Third Cycle Course/GRASMECH Course

Thermomechanical modeling of manufacturing processes: casting and forming

Prof. Diego Celentano,

Prof. Diego Celentano from PUC, Santiago de Chile, will deliver a third cycle course entitled *"Thermomechanical modeling of manufacturing processes: casting and forming"* for a total of 20 hours (5 half days). This course will be supported by FNRS and NCTAM (National Committee for Theoretical and Applied Mechanics). The course will be freely accessible for the whole NCTAM community. The course will be delivered in Liège.

Dates for the course are (always starting at 14h00, finishing at 18h00): 18 September, 25 September, 2 October, 16 October and 23 October.

Room +2/433, Building B52/3 (Institut de Mécanique), Sart-Tilman campus, Liège University.
Access to the building:
https://www.campus.uliege.be/cms/c_1841746/en/b52/3-mecanique-genie-civil-bureaux

Registration and information : JP.Ponthot@uliege.be

See also NCTAM website:
https://nctam.org/doc/Third%20cycle%20course:GRASMECH%20course%20.pdf

Content

1) Introduction to casting and forming processes (6 hours)

1.1. Technological importance, main operating variables and physics involved.
1.2. Description of laboratory tests and experimental results.
1.3. Modeling thermomechanical process in the presence of microstructural effects, large deformations, irreversible response and contact.
- Introduction to the mechanics of a continuous medium with internal variables.
- Extension to large deformations: typical strain and stress measures.

2) Casting processes (6 hours)

2.1. The Stefan problem.
- Governing equations.
- Finite element formulation.

2.2. Generalized phase-change models.
- Governing equations.
- Finite element formulation.

2.3. Modeling microstructural effects during solidification.
- Nucleation and growth laws.
- Application to cast irons.

2.4. Numerical simulations.

3) Deep drawing, stamping and thermoforming (4 hours)

3.1. Constitutive modeling of materials: basic concepts of plasticity and viscoplasticity.
3.2. Modeling of contact and friction.
3.3. Finite element formulation: space-time discretization, integration of constitutive laws, solution strategy algorithms.
3.4. Mechanical characterization via experimental tests.
3.5. Numerical simulations: experimental validation of the numerical results and assessment of the capabilities and limitations of the models.

4) Laser forming (2 hours)

3.1. Thermomechanical formulation.
3.2. Numerical simulations: experimental validation of the numerical results, sensitivity analysis of the material response for variable operating conditions and assessment of the capabilities and limitations of the models.

5) Wire and tube drawing (2 hours)

5.1. Mechanical formulation.
5.2. Numerical simulations: experimental validation of the numerical results, sensitivity analysis of the material response for variable operating conditions and assessment of the capabilities and limitations of the models.