ME-465

Advanced heat transfer

Haussener Sophia

Cursus	Sem.	Type
Energy Science and Technology	MA2, MA4	Opt.
Mechanical engineering minor	E	Opt.
Mechanical engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

The course will deepen the fundamentals of heat transfer. Particular focus will be put on radiative and convective heat transfer, and computational approaches to solve complex, coupled heat transfer problems.

Content

Generalities and fundamentals: Heat transfer by conduction, convection and radiation
Radiative heat transfer: Radiative properties of surfaces, View factors, Radiative exchange between gray and diffuse surfaces, Radiative exchange in enclosures having specular surfaces, Monte Carlo method for surface radiative exchange, Equation of radiative transfer in participating media, Radiative properties of molecular gases and particulate media, Exact solutions for 1D gray media, Approximate solution methods for 1D media, Monte Carlo method for participating media
Conductive heat transfer: Transient and steady state conduction in 0D, 1D, and 2D cases, Conduction in porous media
Convective heat transfer: Boundary layer theory, Laminar boundary layers, External and Internal convective heat transfer

Keywords

Heat transfer, radiation, Monte Carlo methods, convection and conduction

Learning Prerequisites

Recommended courses

Thermodynamics and energetics I
Thermodynamics and energetics II
Fluid flow
Heat and mass transfer

Learning Outcomes

By the end of the course, the student must be able to:

- Explain and apply the concepts of heat and mass transfer, E3
- Implement heat transfer problems using computational tools
- Design codes for solving heat transfer problems
- Interpret solutions to heat transfer problems
- Select appropriately materials for energy conversion systems based on fluids and operating conditions, E11
- Compute and design solar collectors and receivers, E16

Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Demonstrate the capacity for critical thinking

Teaching methods

ex cathedra and exercises

Assessment methods

2/3 written exam during exam session
1/3 computational exercises during semester

Resources

Bibliography

M.F. Modest. Radiative Heat Transfer. Academic Press, San Diego, 2013.
G. Nellis, S. Klein. Heat transfer, Cambridge, 2008.
A. Faghri, Y. Zhang, J. Howell. Advanced heat and mass transfer. Global Digital Press, 2010.

Ressources en bibliothèque

- Radiative heat transfer / Modest
- Advanced heat and mass transfer / Faghri
- Heat transfer / Nellis

Moodle Link

- https://go.epfl.ch/ME-465