CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE

TITLE: Exergy Analysis and Exergy-based Cost Accounting & Optimization

Teacher: Prof. Mauro REINI
Hours: 12
SSD: ING-IND/09 Energy and environment Systems (Sistemi per l'energia e l'ambiente)

Educational objectives: The course aims to enable students to carry out a second principle (exergetic) assessment of components and processes, with particular attention to energy conversion systems. The issues relating to the introduction of time-varying reference environment parameters are also discussed. The concept of indirect energy costs is addressed, presenting different methodological approaches proposed in the literature, such as EMergy Algebra (EMA) and Exergy Cost Theory (ECT). The course aims to develop the critical capacity in the application of the presented techniques of Exergy-based Cost Accounting and Thermoeconomic Optimization.

Contents:

Exergy and EMA
1. flow and non-flow exergy
2. exergy balance
3. chemical exergy
4. exergy degli idrocarburi
5. Definizione di EMergy
6. EMA
7. recycling and multi-product components
8. questioni aperte

Exergy Analysis with time-dependent Reference Environment
1. The Guy Stodola Theorem revised
2. Flow and non-flow availability
3. Flow and non-flow exergy
4. The TMEG
5. exergy balance
6. exergy efficiency
7. Ideal thermal storage
8. Solar + ORC as an example

ECT and Thermoeconomics
1. Indirect energy costs
2. The linear chain
3. Costing, Diagnosi and Local Optimization for the linear chain
4. Exergy Cost Theory
5. Fuel Impact Relation
6. The productive Structure
7. Algebraic Thermoeconomics
8. Examples

Constructal Law and Thermoeconomic Optimization
1. Summary of Constructal Theory
2. Summary of Termoeconomic Optimization
3. The Thermoeconomic Environment
4. The Extended Energy System
5. The Unit Exergy Cost reduction principle
6. The creation of recycling
7. Disposal of residues in the Thermoeconomic Environment
8. Conclusions and perspectives

Teaching methods: Frontal lessons with slide support. Discussion of scientific articles.

Learning assessment : individual interviews and group-discussion of bibliographic references.