

International Brokerage Event
Brussels, 26-27/10/2017



Heat and Mass Transfer Technological Center (CTTC)

Universitat Politècnica de Catalunya
BARCELONA TECH (UPC)

Dr. Deniz Kizildag

deniz@cttc.upc.edu

Description of the Organization

- CTTC director: Prof. Assensi Oliva
- CTTC research co-director: Prof. Carlos D. Pérez-Segarra
- CTTC promoter: Prof. Joaquim Rigola
- CTTC personel: 50 persons full time (30 Ph. D. students)
- More than 100 international journal papers in last 10 years
- **More than 60 research projects with companies, and within national and EU frameworks in last 10 years**

Mathematical formulation, numerical resolution and experimental validation of heat and mass transfer phenomena.

- Natural and forced convection
- Turbulence simulation (RANS, LES, DNS)
- Combustion
- Two-phase flow (VOF, two fluid models)
- Solid-liquid phase change (PCM materials)
- Radiation (surface and participating media)
- Porous media
- Computational Fluid Dynamics and Heat Transfer (CFD&HT)
- Compressible effect and noise evaluation
- Computational Structure Dynamics (CSD) and Fluid Structure Interaction (FSI)
- Aerodynamics
- High performance computing: Numerical algorithms and solvers, parallel computing, etc.



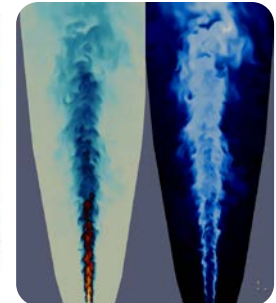
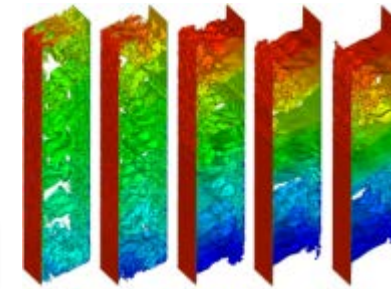
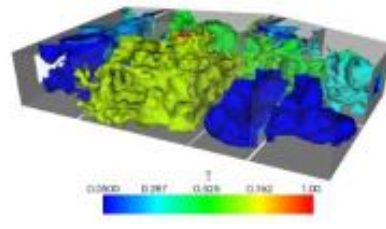
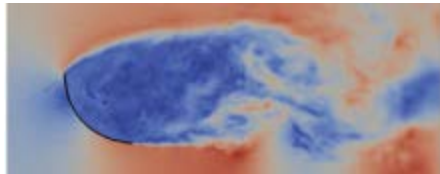
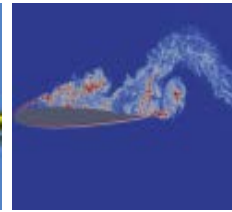
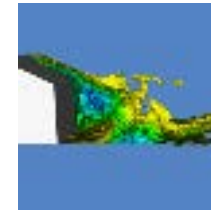
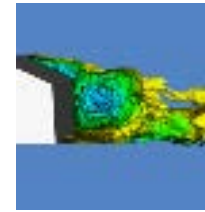
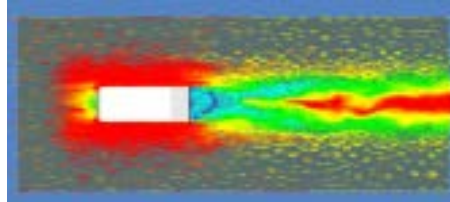
Thermal and fluid dynamic optimization of thermal systems and equipments. Application of the acquired know-how from the basic studies

- Refrigeration (vapour compression cycles, absorption refrigerating systems, compressors, expansion devices, etc.).
- HVAC (ventilation, diffusion of contaminants in buildings,...).
- Active and passive solar systems (solar collectors using transparent insulation materials, building facades with transparent layers and ventilation, etc.).
- Concentrated Solar Plants (CSP) (solar tower, storage tanks, etc.)
- Wind Energy (blade design, thermal nacelle, wind farms, etc.)
- Heat exchangers (single – phase and two – phase heat exchangers, combustion heaters,...).
- Heat storage by liquids and using phase change materials.
- Engine cooling and air conditioning in the automobile and the aeronautical fields.
- Aerodynamics, etc..

Research Activities and Capabilities

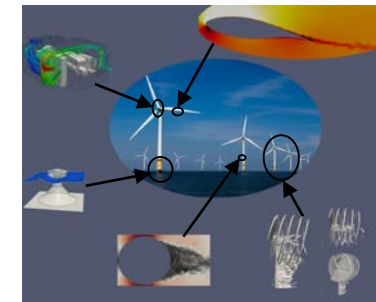
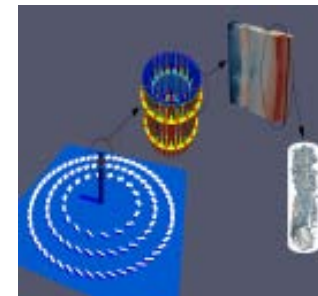
Computational Fluid Dynamics and Heat Transfer (CFD&HT): TermoFluids code

- 3D parallel unstructured code
- DNS, RANS and LES turbulence models
- Dynamic mesh methods for CSD and FSI
- Radiations, combustion
- Multi phase phenomena
- Multi physics modelling



Object Oriented tools for thermal systems and equipments: NEST code

- Modular object-oriented buildings (rooms, walls, HAM+VOC; IAQ, active virtual control): NEST buildings
- Multiscale approach wind energy applications : NEST wind farms
- Multiscale approach solar tower receivers: NEST CSP
- Thermal Energy Storage Tanks: NEST STES & LTES
- Vapor Compression, absorption and adsorption refrigeration and systems NEST cycle
- Condensers, evaporators and radiators : NEST heat exchangers
- Hermetic reciprocating compressors: NEST compressors



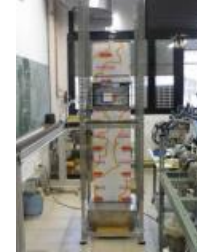
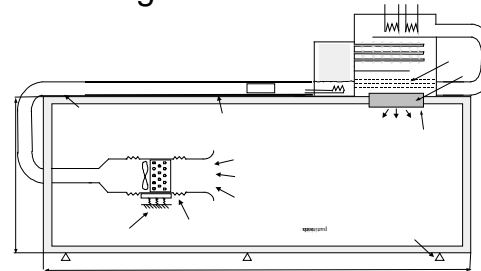
High performance cluster and experimental facilities

CTTC-UPC High Performance Cluster (HPC – JFF)

- Beowulf HPC cluster.
- Infiniband DDR 4X network interconnection between nodes with latencies of 2.25 microseconds with a 20Gbits/s bandwidth.
- The system of files allow unified capacities of several Petabytes highly scalable.
- 128 nodes, each node has two Quad-core CPUs, total of 1024 processing cores.
- 40 nodes, each node has 32 Cores, total of 1280 processing cores.



- Vapor compression refrigerating systems (R600a, R134a, CO₂, etc.)
- Calorimeter compressor test
- Fin and tube heat exchangers test loop
- Climate chamber
- Motor bench
- Storage tanks
- Flat plate solar collectors
- Different types of ventilated façades
- Bioclimatic building



Participation in Relevant Research Projects



1. Research project (H2020-CS2-CFP04-2016-02 **CleanSky project**), Funding: 209300 Euros, Title: ICOPE Innovative Cooling system for embedded Power Electronics, Period: 2017-2020.
2. Research project (H2020-CS2-CFP04-2016-02 **CleanSky project**), Funding: 213125 Euros, Title: MULTIVariable Environmental Control System, Period: 2017-2020.
3. Research Project **ENE2014-60577-R**; MEC (Spanish Government); Funding: 100.000 Euros; Title: Development of high-performance parallel codes and algorithms for the improvement of the efficiency applied to wind-energy, solar thermal and building; Period: 2015 – 2017.
4. Research Project **H2020-686783 Cleansky2**: Funding: 323.812 Euros, Title: MALET Development of MODELICA Libraries for ECS Thermal management architectures, Period: 2015-2017.
5. Research project ref. C-10104; Company: **Huangshi Dongbei Electrical Appliance Co, Ltd.**; Funding: 180,000 euros; Title: Technology Development Cooperation Agreement for LC Series, Period: 2014-2015.
6. Research project ref. ID-620129 (SP1-JTI-CS-2013-01 **Cleansky**); Funding: 180,987 euros; Title: EFFAN – Efficient Fan, Period: 2014-2015.
7. Research project, ref. **FP7- EeB.NMP.2013-3**, E01199; Title: RESEEPE Retrofitting solutions and services for the enhancement of energy efficiency in public edification; Funding: 368.871 Euros; Period 2013-2015.
8. Research project Q-00023; Company: **EIT-KIC InnoEnergy project**; Title: Thermal storage for concentrating solar power plants; Funding: 650000 Euros; Period: 2011-2014.
9. Research project C-08632; Company: **Anortec, S.L.**; Title: Research and development for the aerodynamic design of the blades of aerogenerators; Period: 2011-2012.
10. Research project Q-00011; Company: **EIT-KIC InnoEnergy project**; Title: Energy storage as necessary part of energy balanced building and districts; Period: 2011-2014.
11. Research Project E01053, ref. 218849, **ISP-1; European Commission**, Directorate-General XII; Companies: Snecma, Astrium, AVIO, Mikroma, Alcimed, Bonatre; Funding 206250 Euros; Title: In Space Propulsion 1; Period:2009-2012.
12. Research Project, ref. C07564; Company: **Abengoa Solar New Technologies**; Title: Project “ConSOLI+Da” Consorcio Solar de Investigación y Desarrollo; Subject: Vapour receivers for solar tower power plants; Funding 500000 Euros; Period:2008-2011.

Relevant call topics



2018-2020 Mobility for Growth

- **LC-MG-1-5-2019:** Advancements in aerodynamics and innovative propulsion systems for quieter and greener aircrafts
- **LC-MG-1-7-2019:** Future propulsion and integration: towards a hybrid/electric aircraft
- **MG-3-1-2018:** Multidisciplinary and collaborative aircraft design tools and processes

2018-2020 Green Vehicles

- **GV-01-2018:** Integrated, brand-independent architectures, components and systems for next generation electrified vehicles optimised for the infrastructure
- **GV-02-2018:** Virtual product development and production of all types of electrified vehicles and components
- **GV-04-2019:** Low-emissions propulsion for long-distance trucks and coaches

LC-GV-02-2018: Virtual product development and production of all types of electrified vehicles and components



- Objectives:
 - Development of fully integrated, multidisciplinary, scientific-based and validated design tools using HPC.
 - Development of simulation environments capable of merging the different technologies
 - ...
- Expected results
 - Increasing multipower platforms development efficiency
 - Accelerating uptake of innovations
 - ...

Consortium - profile of known partners

TermoFluids S.L.



HT&CFD – HPC – Multi-scale – Multi-physics– High Efficiency Systems



Dr. Deniz Kizildag

Heat and Mass Transfer Technological Center
Universitat Politecnica de Catalunya
Spain

+34 93 7398004

deniz@cttc.upc.edu

www.cttc.upc.edu