Complementary Numerical Approaches when performing Thermo-Fluid-Dynamic Analyses: A Domestic Example

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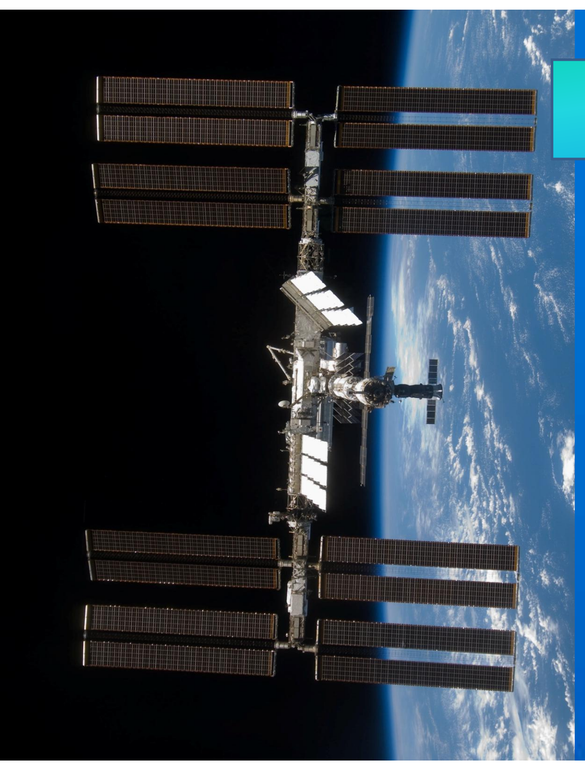
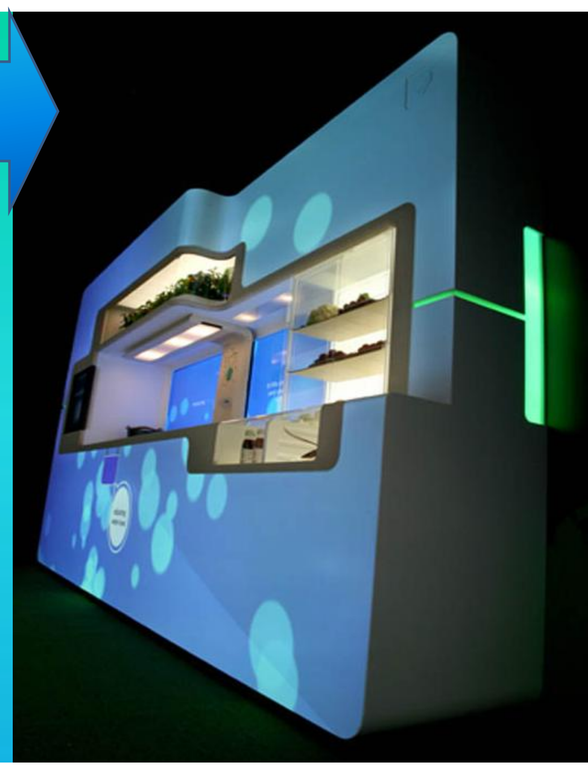
GREENKITCHEN



Advanced Technologies to improve the Kitchen Concept

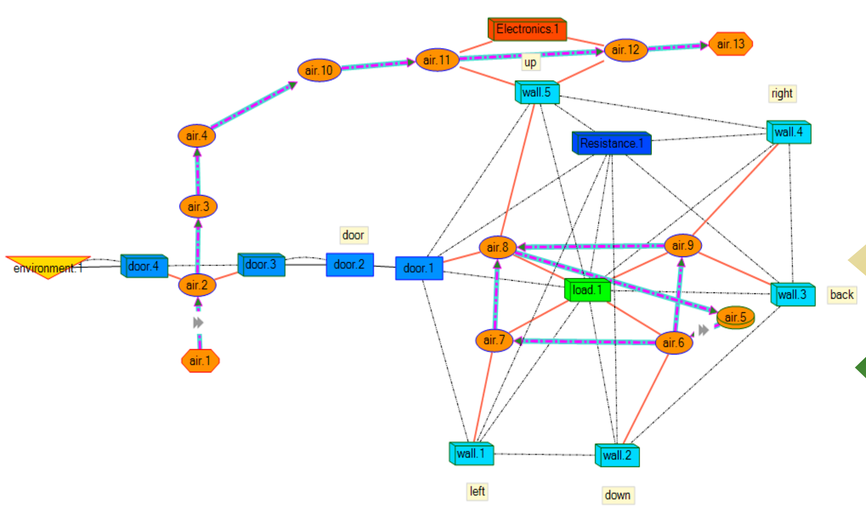
GREEN KITCHEN project [1]:

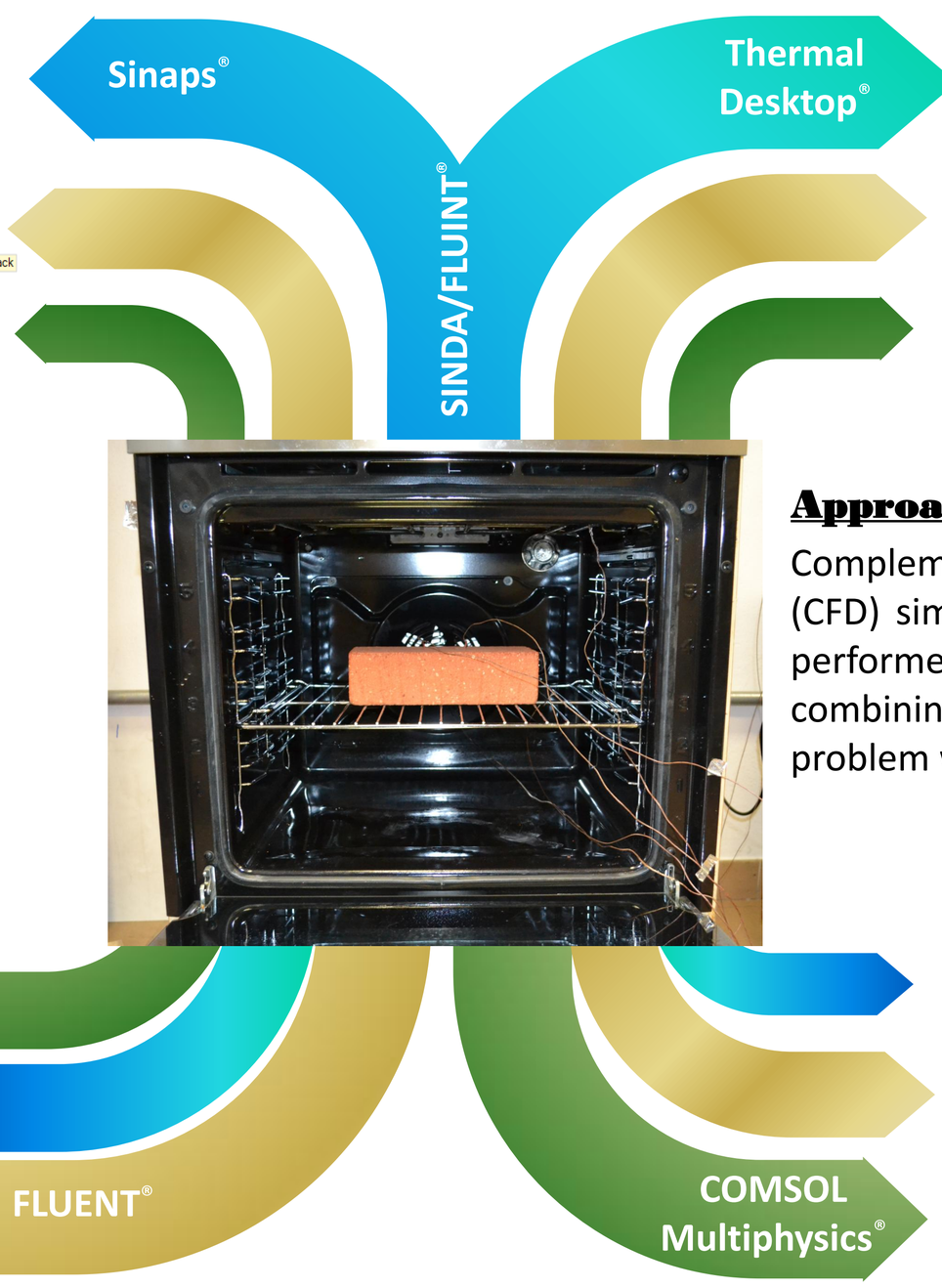
- Resources: Financed by the UE **(IAPP/Marie Curie program)**
- Main target: Integrate a new generation of home appliances with a **Reduced Energy Consumption** and a **Higher Energy Efficiency** in an innovative household environment.
- Task 5.2: Focused in developing **Innovative Heat Transfer Models** for cooking in electrical domestic ovens.
- Tools: **Complementary Numerical Approaches** to study the heat and mass transfer processes occurring in electrical domestic ovens are used.
- Validation: The **Standard Energy Consumption Test** in the European Union EN 50304 is used to validate the obtained predictions.

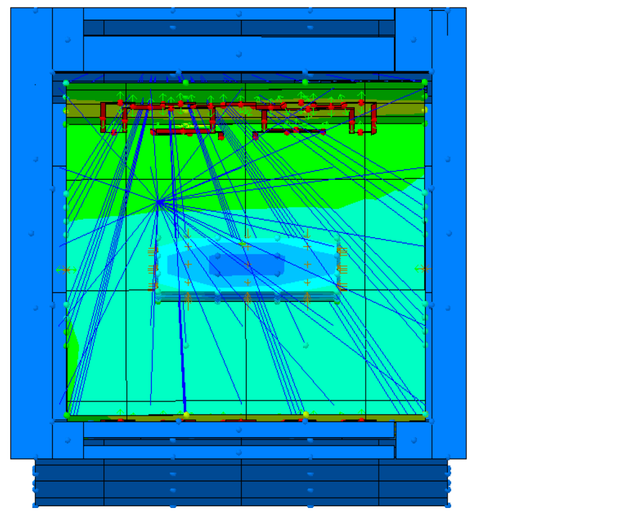


Approach by using SINDA/FLUINT®

The simulation of the heat transfer paths between the different elements of a domestic oven can be performed using a NASA-developed software **SINDA/FLUINT®**[2] With its non-geometric graphical interface **Sinaps®** fast parametric sweep analyses can be obtained. On the other hand, **ThermalDesktop®**, a geometric CAD-based style interface, makes possible a detailed 3D analysis, in special to calculate view factors.

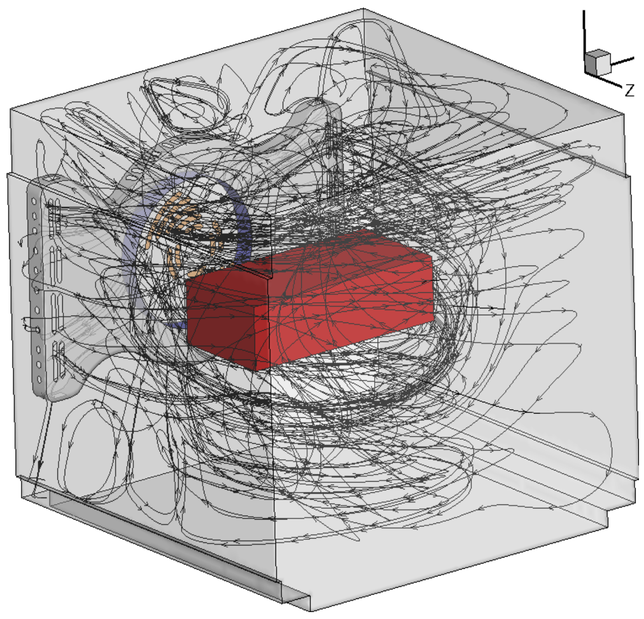






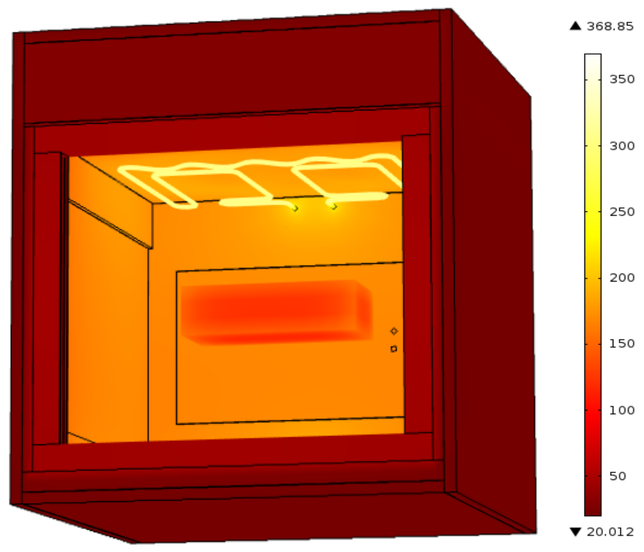
Approach with FLUENT®

A detailed modeling of the fluid flow in the analyzed system can be carried out with the advanced tools of **FLUENT®**[3].



Approach with COMSOL Multiphysics®

Complementary Computational Fluid Dynamics (CFD) simulations of the oven behavior can be performed with **COMSOL Multiphysics®**[4], combining different physics of the studied problem when solving the system.



CONCLUSIONS

- **New Design Strategies** and **Advanced Heat Management** technologies can be evaluated by means of complementary simulations tools.
- **More Efficient Use of the Energy** in the home appliances field can be reached by analyzing theoretically their heat transfer paths and by validating the predictions with the results of **Standard Experiments**.
- Accurate heat transfer models for cooking in the case of the real domestic ovens can be obtained by using **Complementary Numerical Approaches**.

References

1. http://ww.iapp-greenkitchenproject.eu/
2. Cullimore, B. A., Ring S. G. and Johnson, D. A., SINDA/FLUINT® User's Manual, Version 5.5; *C&R Technologies* Inc., October 2011.
3. Niro, A. Modelli e Simulazioni MultiFisica a Supporto della Descrizione dei Fenomeni e dei Processi che Avvengono in un Forno di Cottura. Politecnico di Milano. December 2012.
4. http://www.comsol.com/

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