

## A Design Methodology and Tool to Support Ecodesign Implementation in Induction Hobs

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**Abstract :** Nowadays, the European Ecodesign Directive has emerged as a new approach to integrate environmental concerns into the product design and related processes. Ecodesign aims to minimize environmental impacts throughout the product life cycle, without compromising performances and costs. In addition, the recent Ecodesign Directives require products which are increasingly eco-friendly and eco-efficient, preserving high-performances. It is very important for producers measuring performances, for electric cooking ranges, hobs, ovens, and grills for household use, and a low power consumption of appliances represents a powerful selling point, also in terms of eco-design requirements. The Ecodesign Directive provides a clear framework about the sustainable design of products and it has been extended in 2009 to all energy-related products, or products with an impact on energy consumption during the use. The European Regulation establishes measures of eco-design of ovens, hobs, and kitchen hoods, and domestic use and energy efficiency of a product has a significant environmental aspect in the use phase which is the most impactful in the life cycle. It is important that the product parameters and performances are not affected by eco-design requirements from a user's point of view, and the benefits of reducing energy consumption in the use phase should offset the possible environmental impact in the production stage. Accurate measurements of cooking appliance performance are essential to help the industry to produce more energy efficient appliances. The development of eco-driven products requires eco-innovation and eco-design tools to support the sustainability improvement. The eco-design tools should be practical and focused on specific eco-objectives in order to be largely diffused. The main scope of this paper is the development, implementation, and testing of an innovative tool, which could be an improvement for the sustainable design of induction hobs. In particular, a prototypical software tool is developed in order to simulate the energy performances of the induction hobs. The tool is focused on a multiphysics model which is able to simulate the energy performances and the efficiency of induction hobs starting from the design data. The multiphysics model is composed by an electromagnetic simulation and a thermal simulation. The electromagnetic simulation is able to calculate the eddy current induced in the pot, which leads to the Joule heating of material. The thermal simulation is able to measure the energy consumption during the operational phase. The Joule heating caused from the eddy currents is the output of electromagnetic simulation and the input of thermal ones. The aims of the paper are the development of integrated tools and methodologies of virtual prototyping in the context of the eco-design. This tool could be a revolutionary instrument in the field of industrial engineering and it gives consideration to the environmental aspects of product design and focus on the eco-design of energy-related products, in order to achieve a reduced environmental impact.

**Keywords :** eco-design, energy efficiency, induction hobs, virtual prototyping

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