Phase Changes Materials and Controls in Thermodynamic Models

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1. Introduction

The study of the thermal behaviour of macroscopic systems is quite important because of its usefulness in simulating the temperature behaviour and heat exchanges of local environments. Due to the current condition of an increasing average temperature coming from the global warming, these simulations could help in offering new solutions to reduce the energy consumption and prevent side effects. Here I am proposing and discussing the thermal behaviour of models, which simulate macroscopic structures having some parts consisting of Phase Changes Materials (PCMs). These are materials able to store the thermal energy. Among the various methods for energy storage, those based on the latent thermal energy of PCMs are widely considered as able to provide highly effective systems [1].

2. Models and simulations

As a possible approach to simulate the behaviour of macroscopic volumes, which include some energy storage systems with PCMs, I am proposing the use of models composed of several parts, each obeying the laws of thermodynamics. These parts are interacting with heat exchanges. Some parts are in connection with the external environment. The thermal behaviour of the models is obtained by means of a simulation based on lumped elements, where the description of spatially distributed physical systems is realized through a topology consisting of discrete entities. Under certain assumptions, the simulation with lumped elements, originally developed for electrical systems, is suitable to solve and determine the behaviour of a distributed system [2]. This approach has been already proposed for systems under period conditions [3]. Here, besides PCMs, passive and adaptive controls are included in the models to study the temperature optimization inside specific environments.

3. References

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3. A.C. Sparavigna, S. Giurdanella, M. Patrucco, *Energy and Power Engineering*, Vol.3, 2011, pp.150-157.