HEAT ENGINEERING IN CONSTRUCTION
Fundamentals and applications

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This book was conceived in two parts, complementary in terms of the target pursued, dealing with the heat and mass transfer processes at the level of the building members, as well as with the resultant of these processes at the level of the entire building defined as a thermodynamic layout of the multizone type. Unlike the previous studies which deal in a punctual manner with the building members hygrothermal dimensioning, this one is mainly focused on assessing the buildings energy performance, either in the design phase, or existing, based on which upgrading solutions may be envisaged; the characteristics of these solutions may add to the value of the buildings subjected to study. Actually they represent the fundamentals of a new branch called by the author "buildings energy – related design".

The thermal response of the closing members and of the building as a whole to the objective and subjective thermal loads generated by the natural outdoor environment, on one hand and by the occupants' behaviour on the other, represents the characteristic of the analyzed processes. The main working instrument developed in the study is represented by the heat and mass transfer unsteady-state conditions. The heat transfer state-state conditions are used in the context of certain phenomenological equivalences with the unsteady-state conditions, which allows the use of all the advantages of the modelling in steady-state conditions, without missing anything in terms of the unsteady-state models specificity. The use of the parameter called "virtual outdoor temperature", proposed by the author, facilitates the functional symbiosis of the two classes of modelling the previously mentioned processes. The processes specific to the units of sensitive thermal storage in rock beds and those specific to the thermal storage units in phase change substances of the second type, of the solid-liquid type are also taken into account. These storage units are part of the equipment of the passive modern buildings, together with systems like solar spaces with controlled air flow and water natural cooling systems based on the convective-radiative to the sky combined effect, which are also examined in the work.

The first part of the book approaches the property transfer fundamental processes (related to heat and mass) in a phenomenological description concretized in a "classical" mathematical language, accessible to persons with proper expert background as well as to those who have the curiosity necessary in this field of investigation.

The second part of the book approaches concrete issues related to the heat and mass transfer in occupied buildings, but also specific to the thermal systems meant to provide thermal comfort in the occupied spaces. The work insists on the concept of performance in achieving the state parameters in the occupied spaces; the algorithms of quantifying the quality of heat/cold supply are also provided. A special concern, presented for the first time in the specialized literature in Romania, is the identification of the real thermal characteristics of the existing buildings envelope, referring both to the transparent and opaque building members. The calculation models developed are of the *inverse modelling* type and approach a large range of cases starting from members located in the opaque envelopes field area, up to the building – thermal systems in the building complex.

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