# INTRODUCTION

This number of the "Journal of Engineering Physics" is devoted to the broad subject of heat transfer in building materials and structures.

The thermal design of structures and the choice of the optimal production conditions for building materials are based on the laws of heat physics, but whereas modern heat physics can lay claim to great achievements and is widely used in various branches of industry, the heating engineer relies largely on outmoded methods of investigation and design.

The methods recommended in the building codes not only fail to reflect the modern state of knowledge but do not even correspond to the actual processes of heat and moisture transfer in the walls of buildings and other enclosures.

A distinctive feature of heat transfer in buildings is the fact that it is indissolubly linked with mass transfer (moisture, air) under nonstationary conditions. Accordingly, heat transfer calculations relating to walls must be based on the stationary-periodic state with allowance for mass transfer in the presence of phase transitions. This calls for the extensive use of digital and analog computers.

The existing experimental data on the moisture and heat transfer coefficients of building materials are inadequate and often unreliable, since they do not reflect the actual processes of heat and mass transfer in capillary-porous bodies and disperse media. Thus, one urgent problem is to develop simple, but reliable methods of determining the thermophysical characteristics of the more important building materials. No less urgent is the task of investigating the external heat and mass transfer in relation to the specific function of different structures.

This does not exhaust the list of problems facing the scientists and engineers of the building industry, but it does include those most urgently in need of solution. These are the problems with which the present number of this journal is primarily concerned. Most of the work described was carried out at the Moscow Institute of Building Physics (NIISF), some at the Moscow Institute of Engineering and Construction (MISI), the Institute of Heat and Mass Transfer of the Academy of Sciences of the Belorussian SSR (ITMO), and other research institutes.

The contributions to this number can be grouped according to the fundamental problems of building physics with which they deal.

A. V. Lykov's article "Mass and Heat Transfer in Building Materials" deals with the nonstationary problem of heat and mass transfer in systems of capillary-porous bodies, a class to which the majority of building materials belong. His proposed system of equations reflects the organic link between the transport of heat and air under these conditions. The most rational thermophysical characteristics determining heat and mass transfer in building materials are defined. I. P. Zhuk and L. P. Pisarchik in an article entitled "Heat Transmission Through Outside Walls" demonstrate the inadequacy of the recommended method of calculating the nonstationary regime for the walls of buildings based on the theory of the heat resistance of a semi-infinite mass. They propose a method of designing multi-layer walls for the stationary-periodic case. In "The Significance of Annual Temperature Differentials in the Design of Structures for Climatic Effects" G. G. Eremeev and T. K. Krasovskaya obtain an approximate formula that can be used to estimate the annual temperature differential for structures with low thermal inertia. V. N. Bogoslovskii in "The Moisture Potential" discusses the principle of the calculation of moisture transfer in building materials under nonisothermal conditions. The author treats multi-layer elements as single-layer elements with discontinuous thermophysical characteristics. P. M. Brdlik and B. S. Mezhevnikov give an engineering method of computing nonstationary heat transfer for flooded roofs. It is shown that the chief part in heat transfer is played by solar radiation and surface evaporation. A. G. Gindoyan and A. L. Usov deal with nonstationary heat transfer between the human foot and the floor, the former proposing an engineering method of calculating the heat loss from the foot as a function of the physical characteristics of the material.

The interaction between the walls of a building and the outside medium is the subject of articles by P. M. Brdlik and V. A. Mochalov "Porous Flow at a Vertical Surface in Free Convection" and P. M. Brdlik and I. A. Turchin "Effect of Discrete Flow Distribution on Heat Transfer at a Vertical Surface in Natural Convection," which can be used as a basis for calculating heat transfer through permeable materials and cracked joints. In "Water Vapor Transfer Coefficients for Calculating the Moisture Conditions in Walls" V. M. Il'inskii investigates the conditions under which it is necessary to take into account the resistance to mass transfer at the outside face of a wall, while P. M. Brdlik, I. M. Kozhinov and N. G. Petrov show how to compute the heat transfer coefficient and the amount of condensation on the inside face of a wall.

Questions of air-conditioning and the aerodynamics of heat curtains are considered by L. T. Bykov and V. V. Malozemov in "Some Temperature Distribution Relations for Confined Spaces with Internal Heat Sources," by L. T. Bykov in "Estimation of the Rate of Displacement of Air in a Confined Space with Natural Convection," and by Ya. M. Vizel and I. A. Mostinskii in "Deflection of a Jet Injected into a Stream."

In the article by P. M. Brdlik and V. K. Savin on "Heat Transfer Between an Axisymmetric Jet and a Plate Normal to the Flow" discussion centers on the intensification of the processes of heat and mass transfer in building materials.

Experimental methods of investigating heat and mass transfer and thermophysical characteristics are discussed by V. V. Malozemov and I. A. Turchin, V. F. Rozhnov, V. M. Kazanskii, E. I. Tertichnik, A. Alumyae, Ya. N. Basin, and others.

V. V. Malozemov and I. A. Turchin propose a very simple method of interpreting interferograms for determining temperature fields.

V. F. Rozhnov demonstrates the possibility of using an interferometer to measure the concentration fields of gaseous impurities under isothermal conditions. V. M. Kazanskii proposes theoretical expressions for the dependence of the chemical potential and thermogradient coefficient on the temperature in capillary-porous bodies. E. I. Tertichnik describes the "sectional column" method of determining from a single experiment the dependence of the moisture characteristics of building materials on the transfer potential. Ya. N. Basin et al. explain a method of choosing the optimal parameters for radioisotope devices in connection with problems of building physics.

The editors of the "Journal of Engineering Physics" are confident that the articles published in this number will arouse the interest of scientists and engineers concerned with building construction and the physics of building materials and thereby help to accelerate the development of these branches of knowledge.