

On the Application of the Orthogonal Projection Method to a Heat Conduction Boundary Problem

P. RAFALSKI

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1. **Introduction.** The application of the orthogonal projection method for the solution of partial differential equations of elliptic type was presented by Maurin⁽⁵⁾. In particular Maurin considers the classical variational problem of Dirichlet, expresses it in a new form using concepts from functional analysis and gives an elegant geometrical interpretation of the solution method.

An attempt to extend the orthogonal projection method to other types of equations, namely, the equations describing the non-stationary heat conduction boundary problem, thermoelastic boundary problem and visco-elastic boundary problem has been presented in references 1-4.

In the present work we shall consider the non-stationary heat conduction boundary problem where the thermal conductivity and the specific heat are prescribed functions of position in the considered region.

The problem is described by: the equation of heat conduction, the initial and boundary conditions and the space H , where the solution is sought. Here the space H is a *Hilbert space* and it is defined as the *completion*⁽⁶⁾ of the *unitary space* $\Phi(A)$. The solution of the differential equation means in this work the *weak solution*^(5,12), and therefore, to define it, we have first to introduce the *fundamental space* and the space of *generalized functions* defined on this fundamental space. Then, in sequence, we show that

- (a) the elements of the space H are the generalized functions previously defined,
- (b) they vanish (in the generalized sense) at the initial moment,
- (c) the space H can be decomposed into the *orthogonal sum*⁽⁶⁾ of two subspaces: the subspace H_A of the elements vanishing (in the generalized sense) on the boundary and the subspace $H_{(s)}$ of the elements which are weak solutions of the differential equation.