MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION
OF THE REPUBLIC OF UZBEKISTAN

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UZBEKISTAN ACADEMY OF SCIENCES
V.I.ROMANOVSKIY INSTITUTE OF MATHEMATICS

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# A B S T R A C T S

OF THE VII INTERNATIONAL SCIENTIFIC CONFERENCE
CONFERENCE

## MODERN PROBLEMS OF APPLIED MATHEMATICS AND INFORMATION TECHNOLOGIES AL-KHWARIZMI 2021

**dedicated to the 100th anniversary of the academician**
**Vasil Kabulovich Kabulov**

**15-17 November, 2021, Fergana, Uzbekistan**

***Modern problems of applied mathematics and information technologies al-Khwarizmi 2021:*** abstracts of the international scientific conference (15-17 November, Fergana, Uzbekistan). – Fergana. 2021. p.

The book of abstracts contains the brief description of talks of the participants of the international conference " **Modern problems of applied mathematics and information technologies al-Khwarizmi 2021**". The topics are related to the scientific heritage of Al-Khwarizmi, theory of algorithms, mathematical modeling of nonlinear processes, algebra and functional analysis, differential equations and dynamical systems, ill-posed and inverse problems, mathematical analysis, geometry and topology, computational mathematics, statistical modeling, artificial intelligence and digital technology, information security, digital technologies in education, engineering education.

This collection is intended for specialists in mathematics, applied mathematics and information technology, university teachers and for PhD, master students.

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# APPROXIMATE SOLUTION OF BVP BY RITZ FINITE ELEMENT METHOD USING OPTIMAL INTERPOLATION FORMULA IN $W_2^{(m,m-1)}$ SPACE

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The finite element (FE) method was developed to solve complicated problems in engineering, notably in elasticity and structural mechanics modeling involving elliptic PDEs and complicated geometries.

We consider 1D model Boundary value problem

$$-u''(x) = f(x), \quad 0 < x < 1,$$

$$u(0) = 0, \quad u(1) = 0. \tag{1}$$

There are at least three different type formulation of problem (1) (see, for instance, [4]). These are the (D)-form, the original differential equation, the (V)-form, the variational form or weak form, the (M)-form, the minimization form.

The minimization form for problem (1) is:
Find a function $u$ from the Sobolev space $H_0^1(0,1)$ which gives the minimum to the functional

$$F(v) = \int_0^1 (\frac{1}{2}(v')^2 - fv)dx, \tag{2}$$

i.e. to find $\min\limits_{v \in H_0^1(0,1)} F(v)$.

Corresponding finite element method for approximate solution of problem (2) is called the Ritz method.

In this work we examine the (M)-form, i.e., the Ritz method.

Approximate solution of problem (1) by the Ritz finite element method described in the following steps.

1. Construct a minimization (M) formulation (2).

2. Generate a mesh, e.g., a uniform Cartesian mesh $x_i = ih$, $i = 0, 1, \ldots, n$, where $h = 1/n$, defining the intervals $(x_{i-1}, x_i)$, $i = 1, 2, \ldots, n$.

3. Construct a set of basis functions based on the mesh.

4. Represent the approximate finite element solution by a linear combination of the basis functions

$$u_h(x) = \sum_{i=1}^{n-1} \alpha_i \phi_i(x), \tag{3}$$

where the coefficients $\alpha_i$ are the unknowns to be determined.

Here we use coefficients of optimal interpolation formula constructed in the space $W_2^{(1,0)}$ as basis functions $\phi_i(x)$, $i = 1, 2, ..., n-1$. We show that the obtained approximate solution is more accurate in comparison with an approximate solution when we use hat functions as basis functions.

**15. ADDITIONAL TALKS**