INFORMATION OF DOCTORAL THESIS

Title: **Development of new finite elements based on consecutive-interpolation for 2D and 3D thermal-mechanical problems**

Major: **Engineering Mechanics**

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PhD. Student: **Nguyễn Ngọc Minh**

Scientific supervisors: **1. Associate Prof. Dr. Trương Tích Thiện**

2. Associate Prof. Dr. Bùi Quốc Tính

University: **Ho Chi Minh city University of Technology – VNU-HCM**

Vietnam National University Ho Chi Minh city

This dissertation presents a new group of finite elements based on the integration of consecutive-interpolation procedure into the traditional Finite Element Method. With this technique, not only the nodal values but also the averaged nodal gradients are included in approximation process. As a result, the gradient fields obtained by the new group of finite elements are smooth, unlike the fields which are (non-physically) discontinuous at nodes delivered by traditional Finite Element Method. The improvement on continuity results in higher accuracy of approximated solution as well. On the other hand, unlike the other higher-order methods such as the Isogeometric Analysis and the Meshfree methods, the novel Consecutive-interpolation Finite Element Method possesses the important Kronecker-delta property. Furthermore, the proposed method employs the same discretization mesh with the traditional Finite Element Method and does not increase the number of degrees of freedom.

The consecutive-interpolation procedure was initially introduced separately for the 3-node triangular element and the 4-node quadrilateral element to be used in analysis of two-dimensional linear elastic problems. In this dissertation, the method is further developed to form a new class of finite elements which is suitable for domains from 1D to 3D. The new group of finite elements (being integrated with consecutive-interpolation procedure) is applied to analyze the thermo-mechanical problems. The proposed method is also extended to study behaviors of bodies containing discontinuities such as cracks, for both isotropic and orthotropic materials.

Scientific supervisors	**PhD. Candidate**
Assoc. Prof. Dr. Trương Tích Thiện	Nguyễn Ngọc Minh
Assoc. Prof. Dr. Bùi Quốc Tính	