MINISTRY OF EDUCATION AND TRAINING MINISTRY OF CONSTRUCTION

HANOI ARCHITECTURAL UNIVERSITY
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INFORMATION OF NEW CONTRIBUTIONS OF DOCTORAL THESIS

Title of thesis: **Plastic analysis of the frame structure with steel column and composite steel-concrete beam support the static load.**

Major: **Building and Industrial Construction**

Code: **62.58.02.08**

PhD student: **Hoang Hieu Nghia**

Scientific instructors **1. Assoc. Prof.PhD. Vu Quoc Anh**

2. Assoc. Prof.PhD. Nghiem Manh Hien

NEW CONTRIBUTIONS OF DOCTORAL THESIS:

1. Building the curve (M-ϕ) relationship of the steel and composite steel-concrete beam to determine the tangent stiffness of these components at different points when the material works in the elastic phase, elastic - plastic and plastic. Establish SPH program to build this relationship.

2. Building the equation of elastic limit surface, intermediate plastic surface, fullly plastic surface (failure surface) of the doubly symmetrical wide flange I-section subjected to axial force combined with biaxial bending moments by analytical method and building program to show that surface. The plastic surface depends on the shape of the section and the plastic rotation angle of the section when plastic flow, thus showing the spread plasticity of the steel column cross section during structural analysis. At the same time, based on the plastic surface (interactive surface for bending resistance in two directions), it is possible to test the bearing capacity of the column section, considering that the column section is still in the working state elastic, plastic or has been failured. It has practical significance to evaluate the bearing capacity of the column section corresponding to a certain design load.

3. Building a finite element method and application program for nonlinear analysis of the frame structure with steel column and composite steel-concrete beam considering the plasticity of the material and the spreading plasticity of the structural system. The method has reliability and accurate results compared to the actual working of the structure, significantly reducing the size of the problem of structural analysis, increasing the calculation speed quickly.

- Building plastic multi-point bar elements to describe the formation of plastic hinge, the spread of plastic deformation areas on element length. Building vector loading for plastic multi-point bar elements.

- Building a stiffness equation that changes along the length of the element in the form of a cubic equation and building a tangent stiffness matrix of a plastic multi-point bar element when considering the plasticity of the internal section of the element.

- Determination of internal force, displacement of the structural system for each supported load level, calculation of the limited load λ_p of the structural system, plastic flow rate of the section, the order of formation of plastic hinge and behavior spread of plastic of plane frame subjected to static load and assess the amount of safe reserve of the bearing capacity of the component through the yield ratio of the section to the design data.

- Applied for plastic analysis of some problems for results and compared with experimental results, numerical analysis results of other studies to evaluate the accuracy of the proposed theory in the thesis. The comparison results show that the proposed method has high accuracy and reliability.

Scientific instructors **PhD student**

Vu Quoc Anh **Nghiem Manh Hien** **Hoang Hieu Nghia**