ANALYSIS OF ULTIMATE LIMIT STATE (ULS) USING IDEALIZED STRUCTURAL UNIT METHOD (ISUM) ON RECTANGULAR PLATE ELEMENT

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ABSTRACT

Emphasis on the design of the structure has moved from the allowable stress design to limit state design, because the limit state approach has more advantages. Limit state proved able to access the limits strength of a real structure. And one of the calculation of limit state design criteria is the ultimate limit state (ULS). FEM although very powerful in solving problems of non-linear structure, but the FEM also has weaknesses in analyzing non-linear structures that are large. The difficulty is in modeling the complex structure and a lot of time in numerical calculations. This raises ISUM elements for modeling the structure as an array of different types of the unit structural elements. By using ISUM numerical calculations of elements in non-linear structure will be more effective and efficient.

The purpose of this study was to examine the behavior of non-linear structure until ULS condition and influence of imperfection fabrication on the structure using the method ISUM. Form of the selected element is a rectangular plate that idealized into four nodal point and each nodal having six degrees of freedom. The numerical program carried out using MATLAB software. The resulted of the comparison between the program ISUM using MATLAB software with analytical calculations showed that for structural analysis in the elastic regime produces almost the same value (percentage error (0-8224)%). Influence of imperfect fabrication in the analysis ULS resulted buckling structure does not happenned naturally. So that in the modeling structure is modeled using a flat plate with initial deflection (imperfection fabrication) was calculated using the theory of non-uniform membrane stress.

Key words: ultimate limit state (ULS), finite element method (FEM), Idealized Structural Unit Method (ISUM), rectangular plate, buckling and imperfection fabrication.