**BUCKLING BEHAVIOR OF PLATE AND TUBULAR STRUCTURES**

**ABSTRACT**

The study of buckling behavior of tubular and cellular structures has been an intriguing area of research in the field of solid mechanics. Unlike the global Euler buckling of slender structures under compressive loads, tubular and cellular structures deform with their walls buckling as individual supported plates. The aspect ratio and the dimensional characteristics of the tube define the buckling behavior of any tube structure. In this thesis, a thorough study on the buckling of polygon tubular structures with different cross sections is discussed. In the first study, the theoretical buckling formulation of a square tube using the energy method is reviewed from existing solutions in literature. The elastic critical load of a square tube derived from the theoretical solution is then compared with results of finite element elastic buckling simulations. The formation of lobes along the height of the walls at different aspect ratios of the tube is investigated and compared to theory. Also, the buckling behavior of multi-wall structures is studied and the relationship between these structures and a rectangular simply supported plate is established. A brief study on the buckling behavior of rhombic tubes is also performed. The results of the simulation match closely with the theoretical predictions. The study is then extended to quadrilateral tubes with cross-sections in the shape of square, rectangle, rhombus and parallelogram. The theory of buckling of these tubes is explicitly defined using classical plate mechanics based on the previous works presented in literature. The results of the simulations and experiments are observed to be consistent with the theory. Using the formulation of plate buckling under different boundary conditions, the buckling behavior of triangular tubes is also determined. A theoretical formulation for calculating the critical load of triangular tubes is derived. The theoretical critical loads for a range of aspect ratios are compared with corresponding finite element simulation results. The comparisons reveal high degree of similarity of the theoretical predictions with the simulations.

Simulation is carried out in ansys apdl.