CE 890 Graduate Seminar

SPEAKER: Shahin Nayyeriamiri (Dr. Rasheed's Ph.D. student)

TOPIC: "Post Buckling Behavior of Hemispherical Shell Subjected to Concentrated Load"

DATE: November 11, 2009

TIME: 4:00 p.m. (refreshments at 3:45 p.m.)

PLACE: 2144 Fiedler Hall

ABSTRACT

A spherical shell is able to resist higher pure internal pressure loading than any other geometrical vessel with the same wall thickness and radius. Accordingly, the major component of a pressure vessel is often a spherical shape. In practice, most pressure vessels are subjected to external loading, introduced by connections, in addition to internal pressure. Consequently, they should be designed to carry on the worst combination of loading without failure. The load transmitted by a cylindrical rigid actuator applied at the summit of the sphere is one of the most common external loads. Thus, it is important to study its effect on the buckling and post-buckling of this type of shells. This study presents the theoretical, numerical, and experimental results for metal hemispherical shells loaded vertically at the very top into the post buckling range. It illustrates the importance of geometry changes on the buckling load as well. The ideal structure that is studied is shown in Fig. 1. The hemispherical shell is rigidly supported around the bottom circumference and the load is applied by rigid cylindrical boss at the very top of the shell. The subsequent lack of uniqueness of the deformation mode is referred to as degeneration of the deformation. Mechanisms for the initial collapse and subsequent propagation of the plastic deformation for rigid-perfectly plastic shells are formulated on the basis of Drucker and Shield's limited interaction yield condition. The effect of the radius of the boss, used to apply the loading, on the initial and final collapse load is studied. In the numerical model, the material is assumed to be isotropic and linear elastic perfectly plastic without strain hardening obeying the Von Mises yield criterion. In the end, the results of analytical solution are compared and verified with numerical solution results by using ABAQUS software. Good agreement is observed between the load-deflection curves obtained from the analytical and numerical approaches. The preparations to conduct experimental verifications will also be highlighted, Fig. 2.

Fig. 1. Geometry of post buckling of hemispherical shells subjected to concentrated load

Fig. 2. Samples construction procedure for experimental study