



Fig. 171 Elastic-plastic analysis of the **optimized unstiffened equivalent ellipsoidal shell with thick apex, $t(\text{apex})=0.4$ inch; $W_{\text{imp}}=0.2$ inch; the optimum design is listed in Table 78.** This figure is analogous to Fig. 167 and pertains to the same optimized shell. Shown here is the state of the shell after the load factor PB from the previous figure has been removed. The shell is now unloaded, and the **residual dent** of depth 0.2971 inch is generated by plastic flow. The amplitude of the imperfection (the residual dent) significantly exceeds the amplitude, $W_{\text{imp}} = 0.2$ inch, of the axisymmetric linear buckling modal imperfection in the presence of which the shell was optimized. Here the residual dent is produced by the application and removal of pressure on a **single finite element** (like a single normal, inward-directed concentrated load). Compare with Fig. 182, for which the residual dent centered at the same location is produced by the application and removal of a $\cos(\theta)$ distribution of normal, inward-directed concentrated loads along a circumferential line from $\theta = 0$ to 90 degrees. The residual meridional plastic strains, e_{px} , at the outer and inner fibers of the shell skin are displayed in the next two figures.