

Structural Analysis

Below is an offshore platform under construction. Such large steel structures are used for discovery and subsequent recovery of oil or gas from deep wells beneath the ocean floor. Platforms like this one must be constructed to withstand extreme environmental hazards, such as North Sea winter storms or Gulf of Mexico hurricanes. The structure must also withstand damage from dropped objects, boat impacts and general use loads on the structure.

Engineers at Engineering Dynamics, Inc., Kenner, Louisiana, faced a difficult reconstruction task when the bracing element of an 800-foot-tall offshore oil recovery platform collapsed under the action of hydrostatic pressure; a number of reinforcing external ring stiffeners in the tubular brace were also damaged. The problem was twofold:

the engineers had to learn the cause of the collapse and analyze the proposed repairs to the structure.

For computer structural analysis, Engineering Dynamics selected STAGSC-1, a program with the needed geometric nonlinear and buckling analysis. The program was obtained from NASA's Computer Software Management and Information Center (COSMIC) at the University of Georgia **(see page 140)**.

To stress analyze the structural elements involved in the repair task, STAGSC-1 required engineers to describe the damaged area in mathematical terms, giving the geometry, external loadings — such as hydrostatic pressure at the depth of the brace — and other environmental loadings imposed on the brace by platform actions. The type

of material used to construct the platform was also a key factor in the stress analysis.

Given these variables, STAGSC-1 calculated the stress values on the brace and provided researchers with a buckling analysis coefficient that allowed them to determine the overall deflected shapes and buckling shapes of the modeled structural elements. This permitted visual imaging of the structure right at the point where it would begin to buckle under hydrostatic pressure. It was then determined that the proposed repairs would restore the platform to its designed state. Engineering Dynamics reports that the excellent technical capabilities of STAGSC-1 played an important part in enabling completion of the repair task within the allowed time frame.

*Stress
analysis
software
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difficult
reconstruction
task*

