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NASA TECH BRIEF

Manned Spacecraft Center

Fracture Mechanics Evaluation of Ti-6A1-4V Pressure Vessels

The problem:

To calculate the maximum potential flaw depth for Ti-6A1-4V pressure vessels after a specific cyclic pressure history.

The solution:

A computer program for the fracture mechanics evaluation of Ti-6A1-4V pressure vessels.

How it's done:

The program calculates the maximum potential flaw depth after a specific cyclic pressure history. The maximum potential flaw depth screened by the proof test is established, and the growth of this potential flaw is evaluated by chronologically calculating the cyclic flaw growth of each pressure cycle subsequent to the proof test. This determines the maximum potential flaw depth at any given time.

The resultant influence of the maximum flaw depth on predicted tank capability is shown in two ways. First, the maximum acceptable temperature at a selected evaluation pressure is determined for those pressure vessels whose predicted capability is influenced by temperature. This is accomplished by establishing the stress intensity ratio associated with the maximum potential flaw depth at the evaluation pressure, and by determining the temperature at which that ratio is equal to the threshold of the fluid to be contained in the final pressurization. Second, the remaining cyclic capability is determined. This is accomplished by determining the number of evaluation pressure cycles required to increase the maximum potential flaw depth to a critical value. The critical value is defined by the evaluation pressure and the evaluation temperature of the fluid in the final pressurization.

The program uses Kobayashi's solution to the critical stress intensity equation and an empirical relation for the flaw growth rate of Ti-6A1-4V.

Note:

1. The program could be generalized to allow an assessment of pressure vessels of any type material, but the shape of the vessel must be either cylindrical or spherical.
2. This program is written in FORTRAN V for use on the UNIVAC-1108 computer.
3. Requests for further information may be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10413

Patent status:

No patent action is contemplated by NASA.

Source: D. G. Cox of
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