NASA TECH BRIEF

Lewis Research Center

Computer Program for Thermodynamic Analysis of Open-Cycle Multishaft Power System

The Problem:

A better, more accurate method for thermodynamic analysis of an open-cycle, multishaft power system was required for the study of power production applications.

The Solution:

The first phase in the analysis of any power cycle is the determination of the thermodynamic performance as a function of the cycle variables; this computer program was developed to perform such analyses.

How It's Done:

The program can compute specific power output, specific fuel consumption, and cycle efficiency for power systems having any number of shafts up to a maximum of five. On each shaft there can be any number of compressors and turbines up to a maximum of five each, along with any specified number of intervening intercoolers and reheaters. A recuperator can be included in the system. Turbine coolant flow can be accounted for. The combustion-gas thermodynamic properties are valid for any fuel consisting of hydrogen and/or carbon only. The program should be used with maximum temperatures no higher than about 2000 K (3140°F) because molecular dissociation is not included in the stoichiometry.

The analysis determines specific power output, specific fuel consumption, and cycle efficiency as functions of turbine-inlet temperature, compressor pressure ratio, and component performance factors. Improvements in cycle performance resulting from the use of intercooling, reheating, and recuperation can also be determined.

Equations are included for the thermodynamic properties of the gas, analysis of the fluid state changes in each component, and computation of the system performance in terms of specific power output, specific fuel consumption, and cycle efficiency.

Notes:

1. This program is written in FORTRAN IV for use on an IBM 7090/7094 computer.
2. Inquiries concerning the program should be directed to:

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   Information Services
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30602
   Reference: LEW-12324

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