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Computer Program for the Design of Toroidal Transformers

A computer program has been developed which carries out the necessary calculations for the design of toroidal transformers for use in parallel inverters. Any magnetic tape material may be used in the core and any standard round metal wire may be used in the coil.

In most inverter circuits, the transformer is the heaviest component and usually accounts for a significant fraction of the power loss. Therefore, careful attention to transformer design can have an important effect on system weight and efficiency, but, because transformer calculations tend to be tedious and time consuming, a detailed analysis of the effects of various parameters can be a formidable task. This program relieves the designer of most of the computational details, while he maintains control over most engineering decisions. The number of specifications that must be supplied by the user allows for considerable flexibility and for the exercise of engineering judgment. Furthermore, the speed of the program makes it possible to run a great many cases, economically determining the effect of various parameter changes.

The information supplied to the computer is the input voltage, input current, output voltage, frequency of operation, desired fill factor, maximum I^2R loss in a coil, maximum magnetic flux density, density of the magnetic material, specific core loss, specific apparent excitation power, ambient temperature, desired current density in the windings, and relative resistance and density of the wire if a metal other than copper is used.

The computer output consists of the input and output currents and voltages, excitation current, core identification number, core weight, core loss, approximate regulation, total losses, efficiency, total mass, fill factor, ambient and operating temperatures, final height, diameter, and surface area, frequency, power lost per unit surface area, and, for each coil, the number of turns, size of wire, number of parallel windings, resistance, power dissipated, and mass.

The program contains information on 48 sizes of wire and 90 sizes of magnetic cores, equally divided into two groups called light (high-gain) and heavy (low-gain) cores.

This program has been applied to the design of 2- and 4-kilovolt-ampere transformers and, over a range of frequency from 200 to 3200 hertz, a class of transformers of nearly equal efficiency has been designed. The variation in characteristics of transformers wound on heavy and light cores can also be examined.

Notes:
1. The program is written in FORTRAN IV language for use on an IBM 7094 and the calculation time is approximately 0.0011-minute per transformer.
2. Inquiries concerning this program should be directed to:
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   Information Services
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30602
   Reference: LEW-11878

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