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Data plotting and resistance calculation program

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DATA PLOTTING AND RESISTANCE CALCULATION PROGRAM

This data plotting and resistance calculation program processes the voltage tap and current measurements from superconducting magnet quenches on a Tektronix 4051 Graphic System. The program, written in BASIC, consists of three routines. The first routine performs entry and editing functions for many of the constants which are used by the plot and resistance calculation routines. The second routine plots quench data, either on an x-y plotter or on the graphic system display; the third routine calculates the resistance of each superconducting layer as a function of time.

A list of the questions the program operator must answer to run the program and descriptions of the responses follows.

INITIALIZATION

On starting the program, the operator is asked if the program constants are to be initialized. If the computer memory contains no valid constants, for example, immediately after the program has been loaded into memory, the response is yes and the program constants are set to zero. If the computer memory contains valid constants, for example, the program has been run since being loaded into memory, the response is no and the program constants retain their present values.

After the constants are initialized, the computer asks for the date which is printed on the plots and on the resistance calculation output.

ROUTINE SELECTION

Routine selection, the program vestibule, is the first level of program operation. From the vestibule, the operator chooses to enter constants, run the plot routine, run the resistance routine, or exit the program. To select an option, enter the appropriate letter followed by a carriage return. The options are:

Enter program constants	< C >
Plot data	< P >
Calculate resistances	< R >
Exit	< E >

CONSTANT ENTRY ROUTINE

Anteroom

The options listed in the anteroom of the constant entry routine are:

Enter plot constants	< P >
Enter resistance calculation constants	< R >
Tape read	< TR >
Tape write	< TW >
Exit	< E >

Exit returns the program to the vestibule.

Tape write copies the constants in computer memory onto a magnetic tape file.

Tape read copies the constants in a magnetic tape file into computer memory.

Enter plot constants requests scaling factors and channel inversions for use by the plot routine.

A pair of scaling factors, composed of a minimum value and a maximum value, define the range of a plot abscissa. For each data channel, the program displays the factor pair present in memory and then awaits a response. To change the factor values, enter the new values. To retain the present values, enter a carriage return. To exit the factor entry section and drop to the channel inversion section, enter an < E >.

Occasionally, channels contain inverted data in which case those channels must be specified in the constant entry routine. Enter the inverted channels separated by commas and follow the last entry with a second carriage return.

These channel inversions are specified in either the entry subroutine for plot constants or the entry subroutine for resistance calculation constants. Channels specified in either of the subroutines will be inverted in both the plot routine and the resistance routine.

If no channels are entered, but a carriage return is entered, no channels are inverted. If channel inversions were previously specified and are to be retained, enter an < N >.

Enter resistance constants requests the number of resistances to be calculated, the channels the H-coil and current values are on, which data channels, if any, must be inverted, and values for the divider factors, the inductive constants, and the room temperature resistances. Responding to a question with an < E > returns the program to the anteroom of the constant entry routine; a carriage return leaves the current value unaffected. The program calculates up to 50 resistance values for a channel. The channel inversion section is outlined in the plot entry description. Another section of this subroutine requests values for the divider factors, the inductive constants, and the room temperature resistances. The divider factor is the ratio of the magnet layer voltage to the voltage recorded by the computer; thus, the product of the recorded voltage and the divider factor yields the magnet layer voltage. The inductive constant matches the voltage induced in the H-coil to the voltage induced in a magnet layer. The room temperature resistance is the resistance of a magnet layer when the layer is at room temperature. It is abbreviated RØ.

PLOT ROUTINE

The data can be plotted on the graphic system display or on the x-y plotter. The first question asks which of the two, the screen or the plotter, to use.

All sixteen channels can be plotted consecutively or up to thirty-two individual channels, in any order, can be specified and plotted. Using the latter option, the H-coil voltage and the tap voltage of a layer can be plotted on the same graph. For example, if the H-coil data is on channel Ø, enter Ø, 1, Ø, 2, Ø, 3, ..., and replace the graph paper after every second plot. To enter individual channels, follow each channel number with a carriage return and follow the last entry with a second carriage return. Finally, enter the quench number, the number of data points in each data file, and a comment, which will appear on the plots, of up to 15 characters.

RESISTANCE ROUTINE

Again, the results can be output to the graphic system display or to the x-y plotter and all channels can be analyzed consecutively or up to 16 channels, in any order, can be specified. Enter the quench number and the magnet current before the quench in response to the next two questions.

The resistance points are identified by the time, after the start of data collection, they occur. Enter data sampling period in msec. The data collected before the start of the quench and after the end of the quench can be ignored to improve the resolution of the temperature calculations. The domain of the quench is the number of points which represent the actual quench. Enter the number of points to skip, the number of points in the quench domain, and the number of points contained in the data field.

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