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**Using the Tektronix Advanced
Graphing II Software on the
ORNL Fusion Energy Division
DECsystem-10**

W. H. Gray
K. A. Stewart

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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FUSION ENERGY DIVISION

USING THE TEKTRONIX ADVANCED GRAPHING II SOFTWARE
ON THE ORNL FUSION ENERGY DIVISION DECSYSTEM-10

W. H. Gray

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PREFACE

This work was sponsored by the Oak Ridge National Laboratory Fusion Energy Division Large Coil Program in conjunction with system development on the STANSOL¹ structural analysis computer program.

ABSTRACT

This report documents the use of the Tektronix PLOT 10 Advanced Graphing II (AG2) software as it currently exists on the Oak Ridge National Laboratory Fusion Energy Division DECSYSTEM-10 computer. It pertains to the graphics software library called AG2TCS, which may be used to convert AG2 subroutine calls into display images on the screen of a Tektronix 4000 series storage tube terminal and/or produce display images in .TKF-formatted graphics files for subsequent postprocessing to other graphics devices. Fully described here is the method of accessing this software. It is intended that this document serve as a user's guide to accessing the AG2 software, not as a user's guide to the modification of display image composition; the latter may be found in Tektronix's own reference on this subject.

1. INTRODUCTION

The Tektronix PLOT 10 Advanced Graphing II (AG2) software library² consists of numerous FORTRAN subroutines that are designed to combine simplicity of use with a flexible capability to adjust the size, shape, and format of a display image as it is developed on the screen of a Tektronix 4000 series storage tube terminal. Three calls to AG2 subroutines are sufficient to create a complete, full-screen graph. If the default parameters that are assigned by the AG2 software are unacceptable, more than 40 subroutines are available that permit the user to manipulate his display image to produce the desired appearance. Unlike several of the other graphics libraries available on the Fusion Energy Division (FED) DECsystem-10, the AG2TCS software is a computationally efficient set of subroutines requiring a small amount of the user's core image during execution.

The AG2 software library has been installed without modification according to the instructions contained in Ref. 3. This software library uses the current level 3.3 of the Tektronix Terminal Control System (TCS)⁴ to draw vectors, set up screen windows, output ASCII Decimal Equivalent (ADE) characters, etc. When using the system-supplied command files to access the AG2 software (see Sects. 3-5), the TCS software is automatically searched to resolve global external references.

Any discrepancies between documented capabilities and the existing AG2 and/or TCS software libraries should be reported to the authors of this report.

This report specifically pertains to the software library on REL: called AG2TCS.REL and is organized as follows.

- (1) In Sect. 2 the reader may find out how to access the AG2TCS software library and produce a display image on the screen of a Tektronix storage tube.
- (2) In Sect. 3 the reader may find out how to access the AG2 software and simultaneously produce a display image both on the screen of a Tektronix storage tube and in a .TKF-formatted graphics file.

(3) Section 4 presents an example program in order to demonstrate the correct way to initialize and finalize the AG2 software.

2. ACCESSING THE AG2TEK SOFTWARE LIBRARY

The AG2TEK software library is available to the users of the FED DECsystem-10 by using a command file located on device PUB: in a manner similar to that used to access all other graphics software. Such .CMD files cause the inclusion of all the necessary relocatable object modules (.REL files) without requiring the user to concern himself with the location of the .REL files or the order in which they are loaded.

To execute a FORTRAN program, 'yourpg' in this example, and to use the AG2TEK software library to produce a display image on the screen of a Tektronix terminal, type

```
.EXECUTE yourpg,@PUB:AG2TEK
```

Three inflexible requirements must be met by the user's FORTRAN code:

- (1) There must be a call to subroutine INITT(\emptyset). This is the standard way to initialize the TCS software.⁵ (A call to the ORNL version of subroutine INITT with an argument of zero will force TCS to determine automatically the TTY transmission speed in characters per second.) This subroutine call should be made only once and must be the first TCS subroutine call in the user's program.
- (2) There must be a call to subroutine BINITT. This is the standard way to initialize the AG2 software library. Subroutine BINITT should be called once for each display image, unless the user is creating some special effect.
- (3) There must be a call to subroutine FINITT(IX,IY). This is the standard way to terminate the TCS software. (The arguments IX and IY represent the final position of the alphanumeric cursor in absolute screen coordinates.) This subroutine call should be made only once and must be the last TCS subroutine call in the user's program so that the last internal TCS character buffer is written to the Tektronix screen.

The command file PUB:AG2TEK.CMD loads the relocatable object modules REL:AG2TCS.REL and REL:TCSTEK.REL with 'yourpg' using the /SEARCH switch. These are the only .REL files necessary for this software library.

3. ACCESSING THE AG2TKF SOFTWARE LIBRARY

The AG2TKF software library is available to users of the FED DECSYSTEM-10 by using a command file located on device PUB: in a manner similar to that used to access all other graphics software. This mode of execution allows the user to simultaneously produce a display image on the screen of a Tektronix storage tube and create a display image in a .TKF-formatted graphics file. When using AG2TKF, the user has available to him all of the AG2, TCS, and TCSTKF software. For a description of the TCSTKF software, see Ref. 6.

To execute a FORTRAN program, 'yourpg' in this example, and to use the AG2TKF software library, type

```
.EXECUTE yourpg,@PUB:AG2TKF
```

Postprocessing the resulting .TKF file onto the Versatec printer/plotter is accomplished by typing

```
.PLOT VER:=FOR24.TKF/COMMENT:"HOW ABOUT THIS ONE"
```

Three inflexible requirements must be met by the user's FORTRAN code:

- (1) There must be a call to subroutine INITT(0) or to subroutine INITKF('DECSYSTEM-10 file specification'). These are the standard ways to initialize the TCS software or the TKF software, respectively. (A call to the ORNL version of subroutine INITT with an argument of zero will force TCS to determine automatically the TTY transmission speed in characters per second.⁵ When using subroutine INITKF, a call will automatically be made to subroutine INITT for the user.⁶) Either subroutine call should be made only once and must be the first TCS subroutine call in the user's program.
- (2) There must be a call to subroutine BINITT. This is the standard way to initialize the AG2 software library. Subroutine BINITT should be called once for each display

image, unless the user is creating some special effect.

- (3) There must be a call to subroutine FINITT(IX,IY). This is the standard way to terminate the TCS software. (The arguments IX and IY represent the final position of the alphanumeric cursor in absolute screen coordinates.) This subroutine call should be made only once and must be the last TCS subroutine call in the user's program so that the last internal TCS character buffer is written to the Tektronix screen and/or the .TFF graphics file.

The command file PUB:AG2TKF.CMD loads the relocatable object modules REL:AG2TCS.REL and REL:TCSTKF.REL with 'yourp,' using the /SEARCH switch. These are the only .REL files necessary for this software library.

4. A SIMPLE EXAMPLE

This section demonstrates an example program that uses the AG2TKF software library to draw an exponentially decaying cosine function similar to the example display image in Ref. 6. The following program listing is internally commented and should be sufficiently self-explanatory.

```

PROGRAM RNGAG2
C
COMMON /XD/ XNUM, X(501)
COMMON /YD/ YNUM, Y(501)
C
DATA CON/ 0.2/
C
C INITIALIZE THE TCSTKF SOFTWARE LIBRARY
C
CALL INITKF ('RNGAG2.TKF',0)
C
C INITIALIZE THE AG2 SOFTWARE LIBRARY
C
CALL BINITT
C
C MAKE THE X AND Y COORDINATES OF THE RINGER DATA
C
I = 0
DO 100 T = 0.0, 20.0, 0.05
I = I + 1
X(I) = T
Y(I) = COS(T) * EXP (CON * -T)
100 CONTINUE
XNUM = FLOAT(I)
YNUM = FLOAT(I)
C
C SCALE THE DATA
C
CALL CHECK (XNUM, YNUM)
C
C PLOT THE DATA
C
CALL DSPLAY (XNUM, YNUM)
C
C PAUSE TO VIEW THE DISPLAY IMAGE
C
CALL TSEND
CALL TINPUT (JUNK)
C
C TERMINATE TCS

```

```
C
  CALL FINITT (0, 780)
  STOP
  END
```

To execute this program, the following monitor level command might be typed:

```
.EXECUTE RNGAG2.FOR,@PUB:AG2TKF
```

Successful execution of this program should yield an image similar to the curve in Fig. 1.

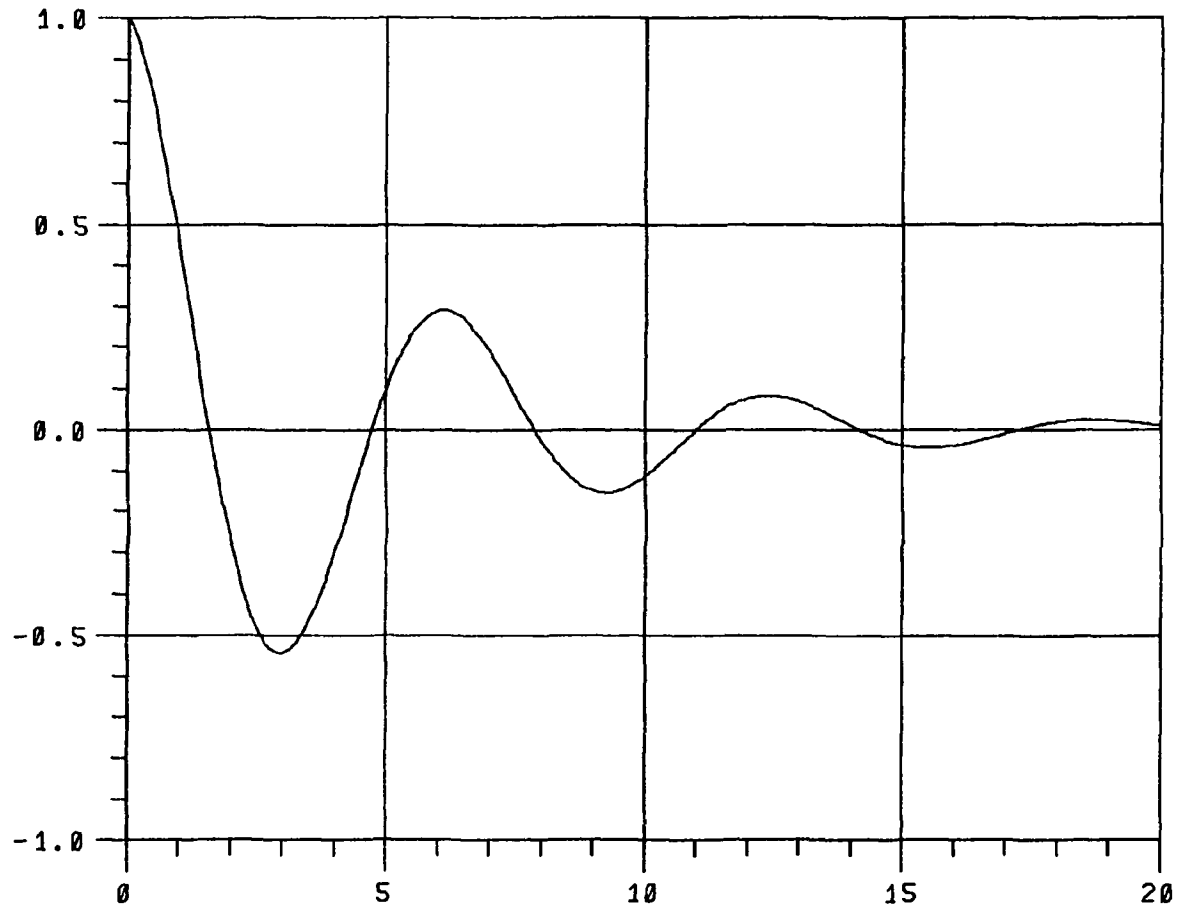


Fig. 1. The display image for the sample problem in Sect. 4.

5. AG2 SOFTWARE IDIOSYNCRASIES

5.1 TCS BUFFERED I/O

The ORNL TCS software uses an efficient, buffered I/O scheme to transmit ADE characters to the screen of a Tektronix storage tube for control of the position of the graphics electron beam. Because of this, the instructions necessary to place text and to move the graphics beam are not, in general, transmitted to the terminal after each TCS subroutine call. These instructions are accumulated in the I/O buffer and sent to the terminal either when the buffer becomes full or when the user instructs TCS to force out a buffer. The TCS subroutine TSEND will force out the current TCS buffer. To overcome this problem, users of AG2 and TCS should make a habit of including the following calling sequence in their programs after the logical ending of a display image:

```
CALL TSEND  
CALL TINPUT (JUNK)
```

The call to subroutine TSEND flushes the TCS buffer to the screen, and the call to subroutine TINPUT waits for the user to input something at his Tektronix terminal. This pause gives the user time to assimilate the resulting display image.

5.2 COMPATIBILITY WITH OLDER VERSIONS OF TEKTRONIX ADVANCED GRAPHING

Tektronix Advanced Graphing I (AG1) software is not compatible with the newer versions of TCS. The FED graphics group does not support any of the older versions of TCS and therefore does not support AG1.

REFERENCES

1. N. E. Johnson, W. H. Gray, and R. A. Weed, "Stress Analysis of Non-Homogeneous, Transversely Isotropic Superconducting Solenoids," Proc. 6th Symp. on Engineering Problems of Fusion Research, Vol. 1, p. 243 (1976).
2. "Tektronix PLOT 10 ADVANCED GRAPHING II User Manual," Tektronix, Inc., Beaverton, Oregon (December 1979).
3. "Tektronix PLOT 10 ADVANCED GRAPHING II Installation Guide," Tektronix, Inc., Beaverton, Oregon (April 1980).
4. "Tektronix PLOT 10 Terminal Control System User Manual," Tektronix, Inc., Beaverton, Oregon (February 1977).
5. W. H. Gray, "User and System Considerations for the TCSTEK Software Library: A Graphics Library for Displaying Images on Tektronix 4000 Series Storage Tube Terminals," ORNL/TM-7353, to be published.
6. W. H. Gray and R. D. Burris, "A User's Guide to the TCSTKF Software Library: A Graphics Library for Emulation of Tektronix Display Images in .TKF Disk Files," ORNL/TM-7383, to be published.