PlotXY - a new plotting program for ATP

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Abstract

This paper presents a new plotting program for ATP, called PlotXY, that has recently distributed to the ATP Community. The program is available via FTP from the anonymous ATP-FTP server or from its mirror in Hanover at addresses:

ftp.ee.mtu.edu/pub/atp/util/plotxy or **130.75.2.2/pub/mirror/atp/util/plotxy**

The main program features are:

- easy-to use Graphical User Interface
- full 32 bit (win32) code for very fast operation
- up to 8 curves per plot
- plots from up to 3 different files on the same sheet
- plots versus time as well as X-Y plots allowed
- factors and offsets and zoom support
- clever automatic axis scaling
- cursor to see values in numerical format

Keywords: User Interface, GUI, ATP, Win32, PL4, Object-Oriented programming.

2 Introduction

A good user interface makes programs more usable, and reduces the time required to obtain the required results. Present-day operating systems' Graphical User Interfaces (GUI's) give high level support of designing good user interfaces. However, to take full advantage of these GUIs, it is normally needed to rewrite the user interfaces of old programs.

Ideally, in the author's opinion, to take the maximum advantage of the GUI's, the ATP computation core, that is the real wealth of the ATP Community, should be integrated with more modern user interface modules, for more user friendly data input and output.

The two main moments in which the user interacts with the program are:

1. when he describes the system to be simulated
2. when he analyses graphically the results.

To improve phase 1, with respect to the traditional use of (one or more) text file(s), now *ATPDraw for Windows* program [1] is available as a graphical user interface, which allows to describe graphically the system to be simulated.

To see graphically the results of simulations, historically two DOS programs have been available: PCPLOT (pure DOS) and TPPLOT (extended DOS). Both programs are very useful tools, but do not take advantage of the graphical User interface of the new GUI operating systems.

Because of this, recently some new initiatives were introduced:

- porting of PCPLOT under the Windows environment (still in progress)
- birth of the ATPGRAPH, mainly thought for Win/NT and OS/2 operating systems.

These initiatives clearly shows a movement of the ATP community towards a more wide used graphical interfaces for ATP.

It is therefore not very advisable to undertake efforts to build new plotting programs for ATP from scratch. However, the author of this article realised some months ago that his plotting program (created for the use with a program completely different from ATP) could be adapted easily to use with ATP, taking into account the author's experience with the PL4 C-like file structure acquired in the past when he co-built and maintained the PL42MAT program [2]. He has therefore decided to invest some of his time in adapting this program to ATP. The result of this effort has been christened PlotXY.

Since the features and the user interface of this new program are much different from those of the new PCPLOT for Windows (WPCPLOT) it is felt that there could be some ATP users that would consider the use of PlotXY as an alternative to WPCPLOT.

This paper presents the program PlotXY, in particular analysing the reason of the choices made when building it, and in general supplying information that has not been included in the program documentation.

3 Basic ideas behind PlotXY

The main specifications the author has considered in building PlotXY are the following ones:

1. both plots versus time and plots of some variables against another
2. possibility to plot several variables simultaneously
3. possibility to plot variables taken from different .PL4 files
4. support for factors, offsets, zoom, with the maximum ease of use
5. program visual aspect/openness.
6. cursor to see numerical values
7. tools to ease the simulation session
8. support for lengthy simulations

Let us discuss the different items separately.

1 While the most important plot type when processing the results of a time domain simulation program is the plots versus time, it is not rare that the plot of one (or more) variable against another is required. Therefore this function has been included, although it has presently some limitations it is not active in case of multi-files (see later), it does not allow to see the numerical values by means of a cursor.

2 One of the problem was to choice the maximum allowed number of simultaneous curves per plot. In principle, it would be easy to pose no limits on this number; in practice, it is observed that the more the curves, the more difficult to differentiate them on the screen or paper so that they are visually easily distinguished. Since PlotXY uses always continuous lines for plots, and it distinguishes the plots only by the use of different colours, there is a practical limit of around 5-10 in the maximum simultaneous curves per plot. The value of 8 has been chosen.

3 Another feature considered very important for the ATP user is the possibility to plot variables coming from different .PL4 files. PlotXY supports the access of maximum 3 such files, simultaneously . This number, (which can be easily raised if there is a request), comes mainly from two considerations:

- since all the files from which you plot simultaneously are completely loaded in memory, many files can rapidly bring to very large memory occupation;
- the legend becomes increasingly complex as long as the number of the involved files increases.

4 Factors and Offsets are arranged in an easy-to use table. They are written in the same colours as the related curves, for maximum clarity. After factors and/or offsets have been defined or modified, the simple issue of a Carriage Return causes the plot to be immediately updated to the new values. To zoom in a particular part of the plot, a simple click–and-drag mouse operation is foreseen. Obviously, also manual definition of scales is allowed.

5 Traditionally, plotting programs have features allowing to put text on the axes and completing the plots with titles, curve names, etc. in user-defined positions. However, today computer programs are more open than in the past. Therefore, the product of a program can be exported into another, specialised for another functions, for additional processing. In the case of PlotXY the author preferred to include a function of object-oriented exporting of plots instead of supplying a text-definition facility. An object-oriented plot can be completely customised by means of a generic drawing program: colours and fonts can be easily changed, other elements can be added such as titles, legends, arrows, etc. In the *Microsoft Windows* operating system, object oriented drawings are coded in the language called *Windows Meta File*, or WMF; in particular in Win32 an enhanced version of WMF, called EMF, or *Enhanced Metafile* is available. PlotXY makes use of the more powerful version of these languages, i.e., EMF, for exporting plots.
One disadvantage of this approach is that very few shareware programs are able to work satisfactorily with the EMF format, at present. This situation will probably change in the near future. However, if there is a sufficient user request, the author can enrich PlotXY with some axis/title editing facility.

6 Every good plotting program should have a cursor to see the “exact” numerical value of the curves shown. This feature is not missing in PlotXY. It is supported in two ways: displaying the exact numerical values read from the binary file(s) or a linear interpolation between two points adjacent to the considered abscissa.

7 When users make ATP simulations, they often make simulation sessions in which they repeat a pattern line this: *simulate - see plots - change something - simulate again*. Often between two simulations only small changes are made in the input file(s), and one wants to see their effect on the same set of variables. To support such a cyclical jobs, a *Refresh* function has been implemented. When the *Refresh* button is pressed, the file already in memory is reloaded (i.e., the file in memory is discarded and a file having the same name and path is loaded from disk), the output variables that were selected remain selected, and the already defined factors and offsets are retained. The *Refresh* feature is clever enough to work smoothly even when a variable selected in a previous cycle is not present anymore in the new version of the PL4 file.

   To see a plot of the currently selected variables, there is a *plot* button. In addition, an *Update* button is present, that causes the current plot to be updated (with the newly selected set of variables, factors and offsets), while retaining the current zoom window of the plot.

8 One of the great advantages of modern operating systems is the ability for multitasking. For the users of a simulation program like ATP, this means that while simulation is in progress, other work can be done with the same computer. For very long simulations this is particular useful, and becomes more useful if one has the possibility to “browse” the current status of the simulation from time to time. PlotXY provides an important feature in this direction. In fact the users of the Watcom version of ATP can plot from a PL4 file even if the actual simulation is still in progress. Moreover, PlotXY can be left open so that from time to time a simple *Refresh* can be issued to update the plot of the currently selected variables.

4 Samples of Program Windows

It was stated earlier, the maximum effort has been made by the author to make the program as easy and fast to use as possible. A two pages file (*Plotxy.doc*) can be found in the distribution kit which describes all the functions of the program in detail. The users are advised to read this short documentation, too, because that quick manual is not repeated here. On the contrary, the next parts of this paper gives an idea of the look and feel of the program.

Since it is believed that for programs having a small number of commands the use of buttons is to be preferred, the PlotXY program has no menus. Instead, two types of buttons are present:

- text buttons, for which the button names are directly shown on their face
- graphic buttons, that have a graphic icon on their face, and the button name can be seen as a text hint showed when the mouse pointer is left on the button face.

The program has two main and some auxiliary windows. The main window contains information on the currently loaded file(s) and its (their) content, as well as about the variables selected for plotting and their related factors and offsets (Fig. 1/a). When the user clicks on the **Plot** button, the Plot window, shown in Fig.1/b, is displayed.

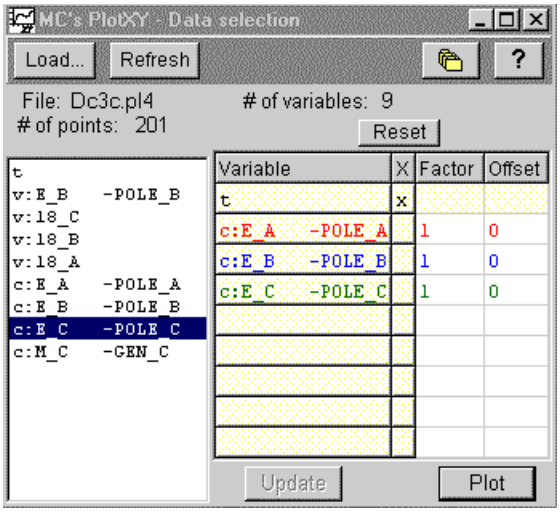

Fig. 1/a - The Main window of PlotXY

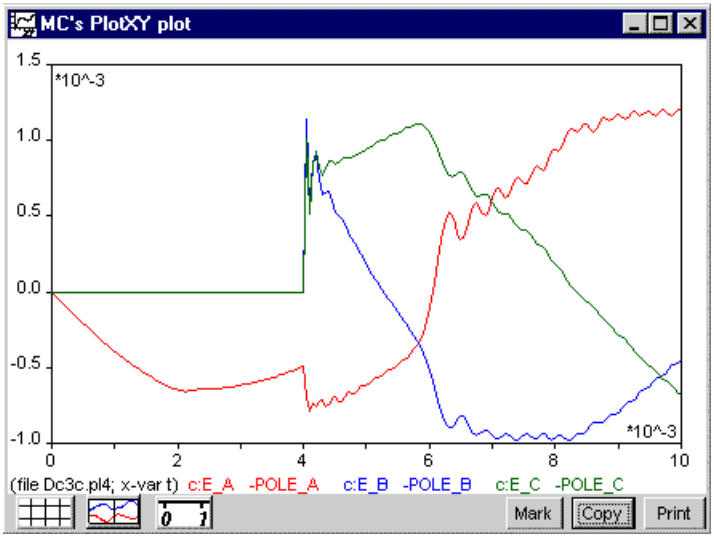

Fig. 1/b - The Plot window

In Fig. 1 the program, with default dimension and position of the windows, shows some plots from data case DC3C.pl4. Although curves are displayed here as gray shades, in the “real world” the curves can be easily distinguished because they are drawn in different colours.

If the user has a B/W printer, and wants to print directly from PlotXY, i.e., without copying and pasting the plot into a drawing program, he has the opportunity to mark the curves with different symbols, as shown in Fig. 2.

The shots of Fig. 1 and 2 refer to the so-called *Basic* or *Single-file* program use.

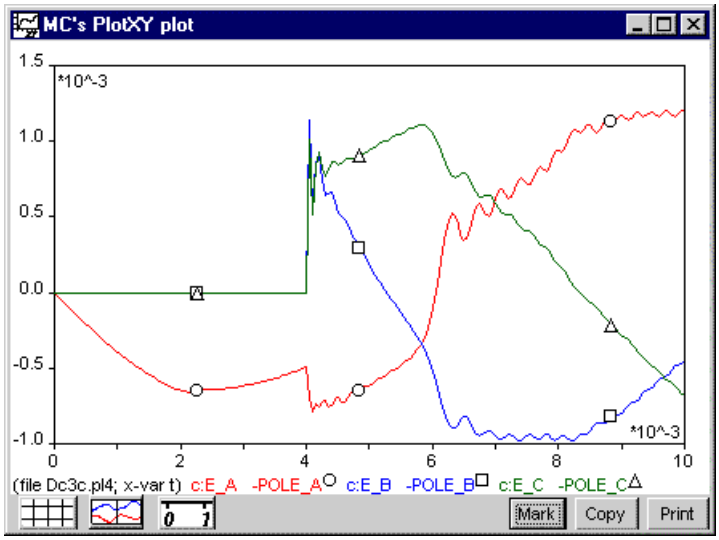

Fig. 2 - Appearance of the **Plot** window with marks on the curves

When, on the contrary, the user wants to display curves from different PL4 files, the appearance of the upper part of the Main window and the plot window will change as shown in Fig. 3/a and Fig 3/b, respectively.

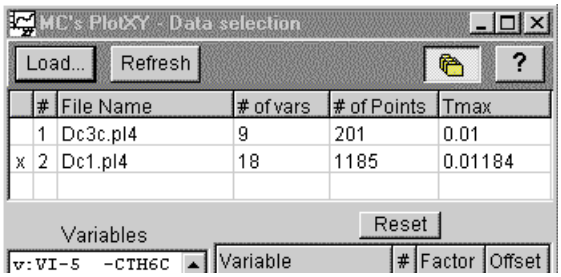

Fig. 3/a - Appearance of the Main window in case of Multi-file use

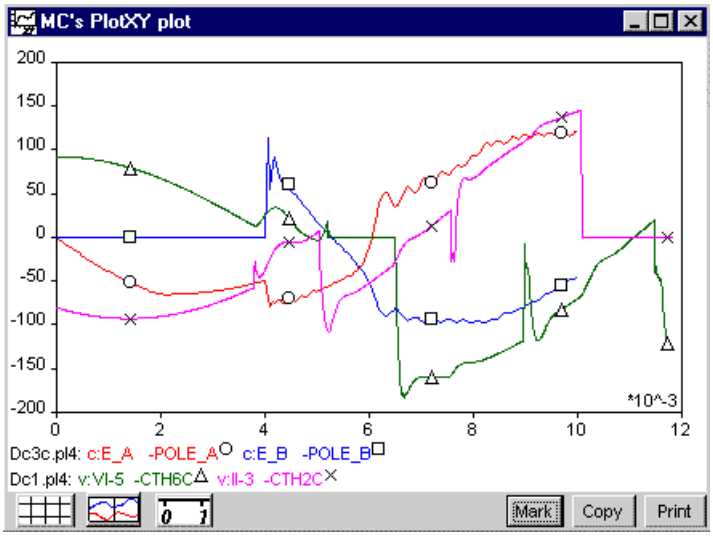

Fig. 3/b - Appearance of the Plot window in case of Multi-file use

The program is still under development. Just to give an idea, after the distribution to the ATP FTP servers, the following new feature has been added: if a valid filename of a PL4 file is passed as a parameter to the program, it automatically loads the file. This can be for instance exploited for activating PlotXY from a DOS window (e.g. issuing “plotxy dc1.pl4”) or associating this program to the pl4 extension in Explorer. In the latter case, double-clicking on a valid PL4 filename causes PlotXY to start and load the clicked file

5 Possible improvements and extensions

The author thinks that no programmer gets to a conclusion of the type: “Now the program is finished. No other function is needed, nothing can be improved anymore.” Probably the opposite is true.

Although the author has searched to put in the first release of the program all the mainly needed features, there are still several things in the priority list, such as:

- possibility to have a cursor also in case of X-Y plots
- possibility to define exactly the *X* and *Y* axis ranges (presently the program can modify the extrema set by the user if it finds that they are not sufficiently *round* numbers).
- possibility to use more than one plot window in the same program instance. This would for instance allow, simply by clicking on the *Refresh* button, to have several views of a data case to be simultaneously updated.

If there is a positive reaction by the users, the program can even be linked to AtpDraw, so that the three pieces: AtpDraw-ATP-PlotXY (of which, obviously, the third is largely the smallest one) work together to provide an integrated graphical simulation environment.

6 Conclusions

PlotXY is a new Plotting program for ATP, with a Graphical User interface, and full 32 bit (Win32) code. It can be an interesting option for those people that prefer GUIs over character-based interfaces.

Coherently with the philosophy of all the ATP products, it is distributed at no cost to the ATP Community.

Since the internal code is object-oriented (written in C++ with the support of the Visual Components Library from Borland), and has been written from scratch in the last couple of years, it can be very easily maintained and developed, as well as integrated with other products.

7 References

[1] H.K. Hoidalen: ATPDraw for Windows, *EEUG News* , Vol 3, No.2, May 1997, pp. 18-23
[2] PL42MAT.EXE program, available with related instructions to use at the ATP FTP sites