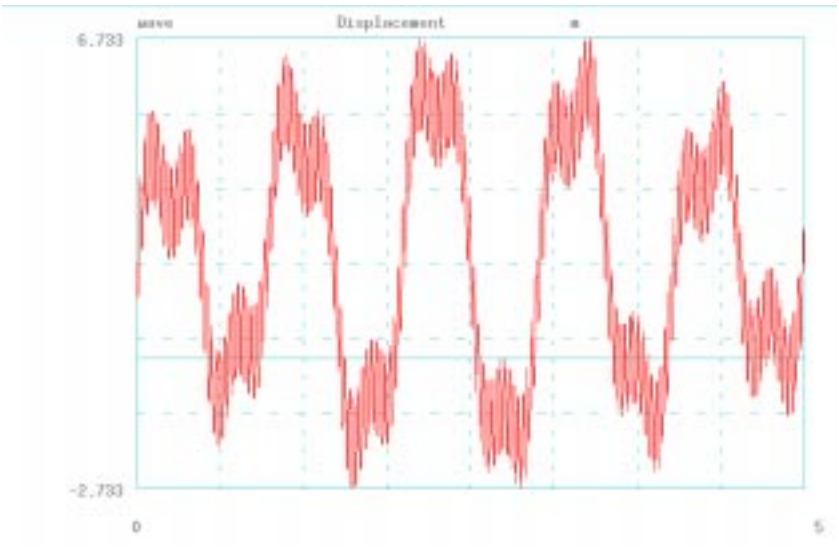
LESSON 1

Loading Time History Management and Manipulation using PTIME



Objectives:

- Create Time Histories using ptime

Problem Description:

Step 1 Problem Description

This exercise is designed to increase your familiarity with the time history creation and manipulation facilities in P3/FATIGUE and to underline the importance of considering the time variation in the loading.

PTIME may be accessed from within PATRAN 3 at the P3/FATIGUE form by picking option **Time History**, or it may be run outside of PATRAN by typing **ptime** at the system prompt.

Once started, PTIME will present a set of screen displays which may be manipulated using the keyboard and/or mouse. A hot key facility is incorporated into all the PTIME menus which is achieved by typing the capitalized letter of the desired menu option, or if using the Xwindow driver, you may click on the option with the mouse cursor.

The top-level menu of PTIME contains options to further sub-menus such as the Add and Modify sub-menus. This multi-menu layering has been necessary to ensure the legibility of each menu.

For proper execution of this exercise, make sure you are in the **ex01** directory in your PAT318 account. Before running PTIME, you must define the graphic terminal on which you are running. The program to set the terminal definition is called PFTRM. Run PFTRM by typing **pftrm** at the system prompt and enter the appropriate terminal definition for your terminal. If you type **list**, you will get a listing of all available terminal drivers. The message **Error initializing terminal - use PFTRM** is displayed if you have not defined your terminal definition properly. To use the mask driver, type **pftrm x** at the terminal prompt.

Step 2 Using PTIME

Run PTIME at the system prompt by typing **ptime**. Upon start-up, PTIME will initialize a new database in your directory and you will be asked to add a time history using one of the options.

In the P3/FATIGUE software system, a menu item can be selected by either moving the highlighted cursor bar to the item and hitting return, or by typing the hot key designated to the item. The hot key is the first capital letter in the description of the item. If you are using the Xwindow terminal driver you may also make selections by depressing the mouse button while the cursor is placed over the particular option.

Choose the **Copy from central** option and select **SAETRN** from the central database. Use the following keystrokes or use the mouse and cursor to select the appropriate options.

Copy from central	Copy from central option.
<F3>	Press the **F3** key to list or click on **List** on the top header bar.
Tag/untag	Tag SAETRN. This means to make sure SAETRN is the highlighted load time history and that an astrix ***** appears next to it.
a**C**cept	Accept SAETRN as the correct time history.

At this point SAETRN is copied from the central location into your local loading time history database. Notice that the number of entries now reads 1 on the main screen. To see that it is really there, pick the **List all entries** option.

List all entries	List all entries option.

Step 3 Graphing Time Histories

Now, from the PTIME main menu select **Plot a time history** and subsequently **STATS** and answer the following questions.

Plot a time history	Accept the default SAETRN by using the **F1** key or click on **OK** on the top header bar.
Stats...	Click on **Stats...** from the side menu and then click on one of the statistics options.

Q1: What is the difference between **F Brief** and **W Brief**? What is the difference between **Brief** and **Full**?

A1:

_____

_____

_____

Q2: What are the statistics of this signal? (Max, Min, RMS, No. of points, sample rate).

A2:

_____

_____

_____

You can leave the graphics portion of PTIME by clicking on **Main...** or **Last Menu** and then **Quit**. Now check some more information about this time history.

Search and list — When the search and list page comes up, press **F1** or click on **OK** on the top header bar.

Q3: What are the database details for this time history?

A3:

_____

_____

_____

Press **F2** to go back to the PTIME main menu from the search and list screen. Use the **Plot a time history** option again to re-plot the time history. Select the **Full X** option on the **Move...** sub-menu. This shows the whole signal. Quit from the graphics now.

At this point you will be manipulating the file you copied from the central database; but first, let us make a copy of the file from the PTIME main menu.

Step 4 Modification of Time Histories

Add a time history — Pick the Add a time history option from the main menu.

Duplicate file — Choose Duplicate file from the resulting sub-menu.

SAETRN — Type in the name of the time history to be duplicated and press **F1** or click on **OK**.

MYCOPY — Type in the new name to be given and press **Return**.

Copy of SAETRN — Type in a description and press **F1** or click on **OK**.

Manipulate **MYCOPY** copy using the **P**olynomial transform option under the **M**odify a time history menu. Use the **P**olynomial option to apply a multiplier of **-0.35** and an offset of **-500**.

Note: Make sure you select **MYCOPY** (not **SAETRN**) to convert.

From the PTIME main menu:

Modify a time historyModify option.

Polynomial transformPolynomial transform option.

MYCOPY Type the name of the time history to transform and press **Return** and then accept the screen by pressing **F1**. You will be asked if you wish to overwrite the existing file. Answer **Y**es.

-500 Constant offset.

-0.35 Linear Scaling Factor. Press **F1**.

At this point you will be asked if you wish to edit the file details. This means changing the descriptions, load type, units, and fatigue equivalent units. Answer **Y**es and use the arrow keys or the mouse to highlight the Load type and Units fields and change these to Pressure in MPa. You may use the **space bar** once a field is highlighted. Change the fatigue equivalent units so that this time history simulates 1/2 hours. When you are finished press **F1**.

From the change details screen:

Load type = Pressure.

Units = MPa.

No. of fatigue equiv units= 0.5

Fatigue equivalent units= hours.

This step is very important as an uncalibrated time history ***may not*** be appropriate in a subsequent fatigue analysis.

Q4: What are the statistics of **MYCOPY** now?

A4:

_____

_____

_____

Step 5 Graphical Editing

Graphically edit the new time history and apply a drift of 100 MPa over the whole signal. See FIGURE 1.. (Hint- use the **Drift** correction after the **Move** and **Edit** options to define the values of Xmin, Xmax, and ΔY at these values.) If you type the letter **K** when the program is asking a questions, you can respond with keyboard input rather than mouse controlled cursor responses. This will help.

From the PTIME main menu:

Modify a time hist Modify option.

Graphical edit Graphical edit option.

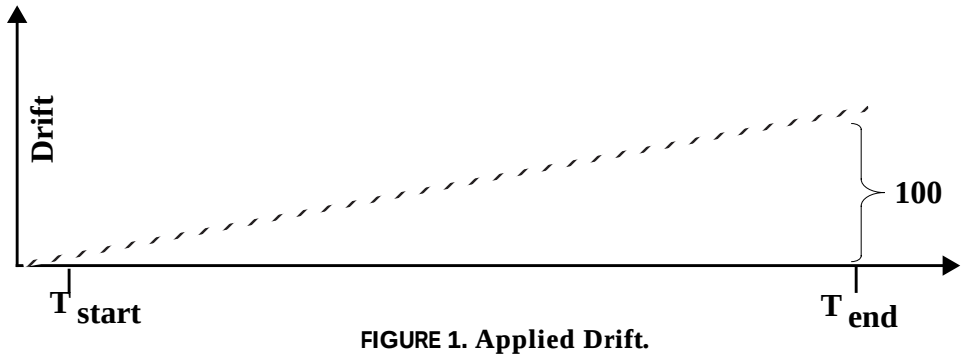


FIGURE 1. Applied Drift.

F1	If this screen shows MYCOPY as the time history to edit, press **F1** otherwise press **F3** to pick from a list. Answer **Y**es to overwrite.
Move...	Chose the **Move... menu** pick from the graphics screen.
Full X	Display the entire signal and then return to the Main graphics menu.
Edit...	Enter the Edit... menu on the graphics screen.
Drift	Pick the Drift option.
K	Switch to keyboard input.
0	Set left x.
1898	Set right x.
0	Enter start offset in signal units.
100	Enter end point offset in signal units. Note the graphics update.

Quit from the graphical edit screen and answer **Y**es to confirmation question in upper left corner of graphics window.

Step 6 Creating a New Time

Create a new loading history using the parameters defined in FIGURE 2. and the waves form creation facilities in PTIME. You will need to use the **W**aveform creation option. The four sine waves are created and summed as each one is created. (Use the **S**ummation option.) Check

the statistics of your time history with the figures shown in FIGURE 2. For the summed history, call the loading history **WAVES** and set the equivalent units to **5 laps**.

Q5: What is the total time of the time history you are about to create?

A5:

_____

_____

_____

Q6: What sample rate will you use and why?

A6:

_____

_____

_____

Only the first wave creation is shown here:

Add a time history Add option.

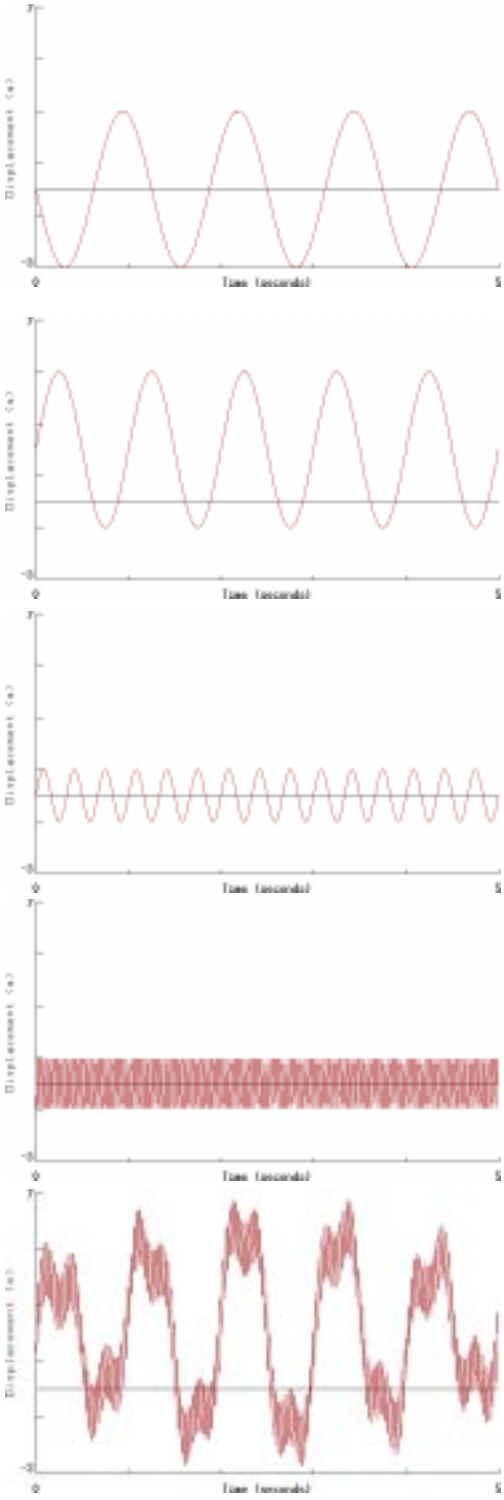
Waveform creation Waveform option.

Now you are in Wave Time History creation window which you need to input at least the following data:

Filename	Filename: WAVE (or any name you want to call it).
Description 1	Enter any description you wish.
Description 2	Is optional
Load type	**Displacement** (use space bar)
Units	**Meters** (use space bar)
# of equiv units	**5**
Equiv units	**Laps**

Press the **F1** key to accept screen values. Select **S**ine option. Then input the following data:

Sample rate	**300**
Total signal time	**5**
Frequency	**0.8**



Frequency =	0.8 Hz
Amplitude =	3.0
Mean =	0.0
Phase(deg) =	180

Frequency =	1.0 Hz
Amplitude =	3.0
Mean =	2.0
Phase(deg) =	0

Frequency =	3.0 Hz
Amplitude =	1.0
Mean =	0.0
Phase(deg) =	0

Frequency =	30.0 Hz
Amplitude =	1.0
Mean =	0.0
Phase(deg) =	180

Summation of the four sine waves shown above

FIGURE 2. Load History WAVES and Components.

Amplitude **3.0**

Mean **0.0**

Phase (deg) **180**

Press the **F1** key to accept screen values.

Next select the **S**ummation option and continue entering the data for the next wave which will be added to the one you just finished entering. Use FIGURE 2. as a guide and when you are finished select the **F**inish option

For example the next wave is:

Next frequency **1.0**

Next Start Phase Angle **0.0**

Form of The Data **Amplitude**

Next amplitude **3.0**

Next Mean of Data **2.0**

Press **F1** key.

When you are finished, look at a graph of this wave.

Type **P** for selecting the **P**lot option.

Now from the graphics main menu select **Move...** and then select **Full X** from the Move... sub-menu.

The graph you see on the screen is the time history you created. Check that it corresponds to the figure attached.

Now, review the files which have been created in the directory by quitting from PTIME: ptime.tdb (Binary), ptime.adb (ASCII), waves.dac, saetrn.dac, mycopy.dac (Binary).

Step 7 ASCII File Import

Finally, use the ASCII convert and load option to read in the file **time.asc**, (which is a free format ASCII time history file) into a binary time history suitable for PTIME and a subsequent fatigue analysis.

Re-enter PTIME now and from the main menu:

Add a time history Add option.

ASCII convert & loadASCII file read option.

Once initiated, PTIME will ask you for the name of the ASCII file to convert, the name of the time history file to create, the sample rate, whether the data is Y-values only or X-Y pairs, if there are any initial lines to skip and whether or not you wish to read in all the data.

ASCII Filename **time** (you do not need a suffix if the suffix is .asc).

Time History Input the name of a the new time history (anything you wish).

Sample Rate You may accept the default of 1.

Equally spcd Data **Y-values only**- If the data consists of X, Y pairs, then by picking **X_Y pairs** will cause PTIME to read each X, Y value and interpolate to define the Y data values at intervals corresponding to the sample rate defined by the user (see below).

Header lines to Skip We wish to read the whole file and not skip any lines. Accept the default of zero.

Take All Number **Y**es

The file may be columnized or data values may be separated by commas. For example:

```
12   13   14   52
11   34   56   23
```

or

```
12,  13,  14,   52
11,  34,  56,   23
```

These values may represent X, Y pairs or Y data only.

If all numbers are taken, then all the numbers in the file will be converted into one DAC file. However, if you respond with No to Take All Numbers, then the next three fields will be presented.

Start Pos for Accpt **1**

This is the column position for the first value, for example in

```
23,   34,   45,   67
78,   21,   43,   54
```

45 is the third number and if this is to be the first value, the answer to this questions should be 3.

No. of Vals to Skp **0**

This is the number of values to ignore, for example in

```
23,   34,   45,   67
78,   21,   43,   54
```

to obtain a file containing all of column 3, the answer to this question would be 3; i.e. skip 67, 78 and 21.

No. of Vals to Tak **1**

This is the number of values to take, for example in

```
23,   34,   45,    67
78,   21,   43,    54
```

to obtain a file containing all of the column 3 and 4, the answer to this questions would be 2 (and the previous questions would have had to been answered 2 also).

The sample rate is the number of values per X-axis increment (usually time). So for 1 value every 0.1 seconds, the answer to this questions is 10, i.e., 10 values per second (10Hz). The number of data values per second is only important in fatigue crack growth calculations since the crack growth rate is sensitive to the loading rate. The equivalent units facility allows the user to define time units more appropriate to the actual analysis being carried out and so the sample rate could be set to 1 if the total time for the file is unimportant.

Once you have defined how the ASCII file is to be read, you will be presented with the Change Details screen where you must enter a description and modify the Load type, Units, and Fatigue equivalent units if necessary. Fill this screen out anyway you please and press F1. Graph the time history. It should look like a bunch of constant amplitude peaks and valleys with some flat spots in-between.

Try reading the file in a few times with different settings, such as the number of data values to skip and see if you can’t guess what the resulting time history will look like.

A1: **F** means statistics on the **F**ull time history whereas **W** means statistics on only the portion of the time history that appears in the **W**indow. **Full** gives you more information than **Brief** does and therefore spawns you back to the non-graphical portion of PTIME whereas **Brief** places the statistics in the top left corner of the graphics screen

A2: No of points=17081,
Start time 0,
End time=1898,
Max=999,
Min=-495,
RMS=451.3,
Standard deviation=235,
Mean=385.3,
9hz sample rate

A3: SAETRN
Description: SAE Standard transmission loading history NORMALIZED TO +/-999
Load Type: Uncalibrated
Unit Type: None
Number of fatigue equivalent Units: 1
Fatigue equivalent units: Repeats

A4: MYCOPY
Description: Copy of SAETRN
Load Type: Pressure, Unit Type: MPa
Number of fatigue equivalent Units: 0.5
Fatigue equivalent units: Hours
No of points=17081,
Start time 0,
End time=1898, Max=-326.8,
Min=-849.7, RMS=640.2,
Standard deviation=82.29,
Mean=-634.8,
9hz sample rate

A5: 5 sec.

A6: We recommend a sample rate of at least 10 times the ***maximum frequency***, because the maximum frequency of the highest waveforms is 30 Hz, 300 Hz is recommended.

$Sf_{sample} = 30 \text{ X } 10 = 300 \text{ sample/sec.}$