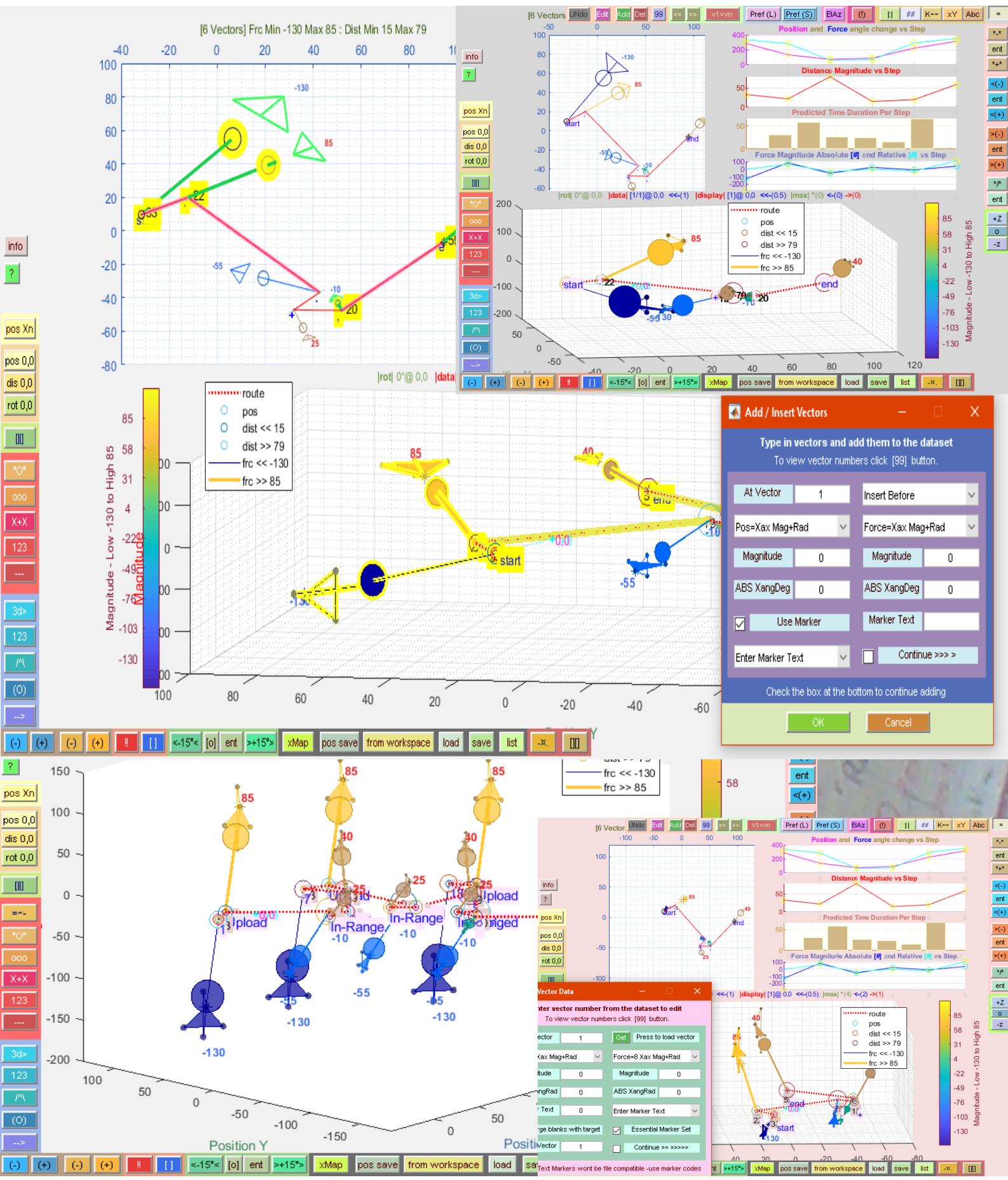


Lottie Vectors

(manual for version 2.0)

A Great Way To Display Vectors!

— twitter.com/mathlottie

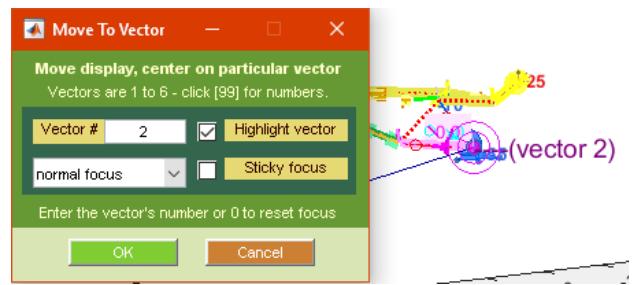


Lottie Vectors

« Manual For Version 2.x »

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cameil@netcourrier.com



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Cover Illustration – collage or screenshots taken from Lottie Vectors 2.0, some during development.

Preference



The use of vectors in mathematics spans the sciences including mechanics, fluid dynamics, electromagnetism and transportation. They find their uses as a clear way to describe many quantities and ideas such as fields that would otherwise perhaps lurk behind complicated obtuse equations. It's much easier to 'see' something visual like a vector field, or a map and different information can be discovered with the whole picture.

This software aims to provide a means to visualize vectors, both position vectors and force vectors in a clear and easy to manipulate way. It uses the MatLab(r) platform, and produces its main output through a figure window. Version 2.x takes on 2 dimensional vector datasets in a common simple format, that lends itself to be transferred over email or even text messages! You'll hopefully find that with 8 different types of 'vector' each of those 8 can be either a force or position vector, there are a good number of choices for your datasets.

With version 2.x you now also have the chance to add and edit vectors from within the window. Clicking on the buttons at the top of the screen open two different windows that allow you to input vectors from drop down boxes. The format they use is the same as the files and variables used by the software. It may take a little time to get used to the format, but you really need an understanding of it to make the most of the features.

The manual is being produced alongside the release of 2.x, as this is available online errors / additions will be made later and an expanded manual produced as time allows.

Thankyou for trying out Lottie Vectors, I hope you enjoy the software as much as I did in writing it. Which, by the way, I did!

May the force vectors be with you!

Charlotte Élisabeth Ameil

October 17th 2018, UoE

What's new in Version(s) 2.x ?

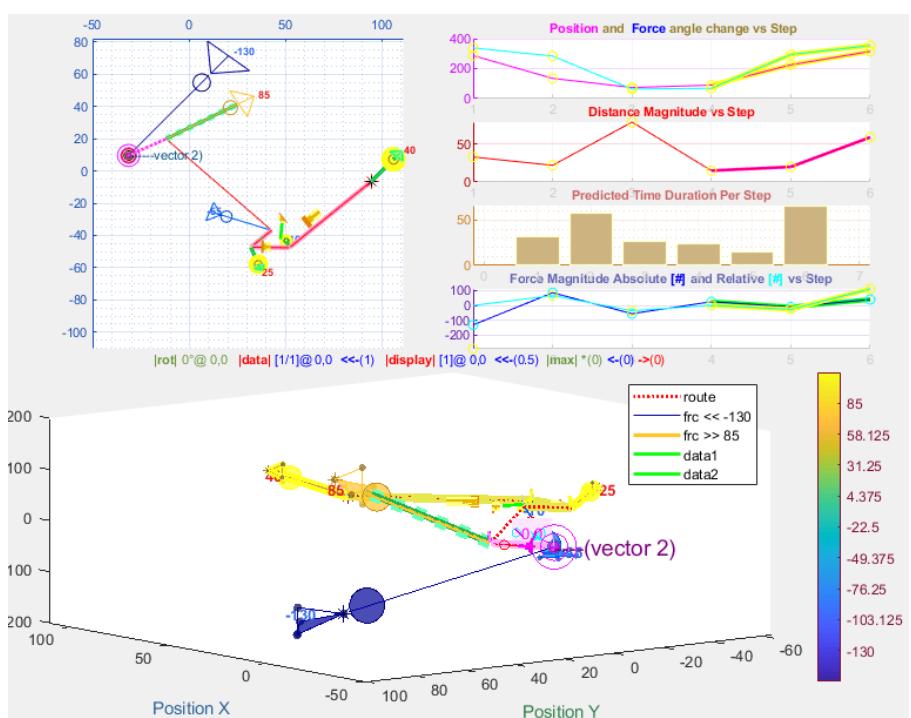
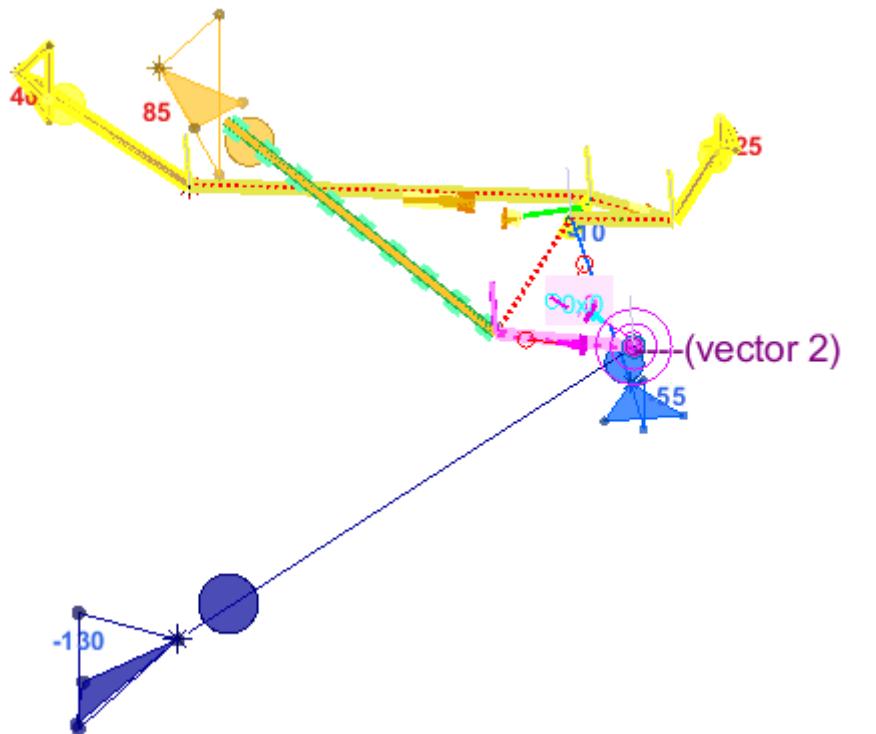
Below is a list of some of the new features in 2.x over 1.x versions

Welcome !

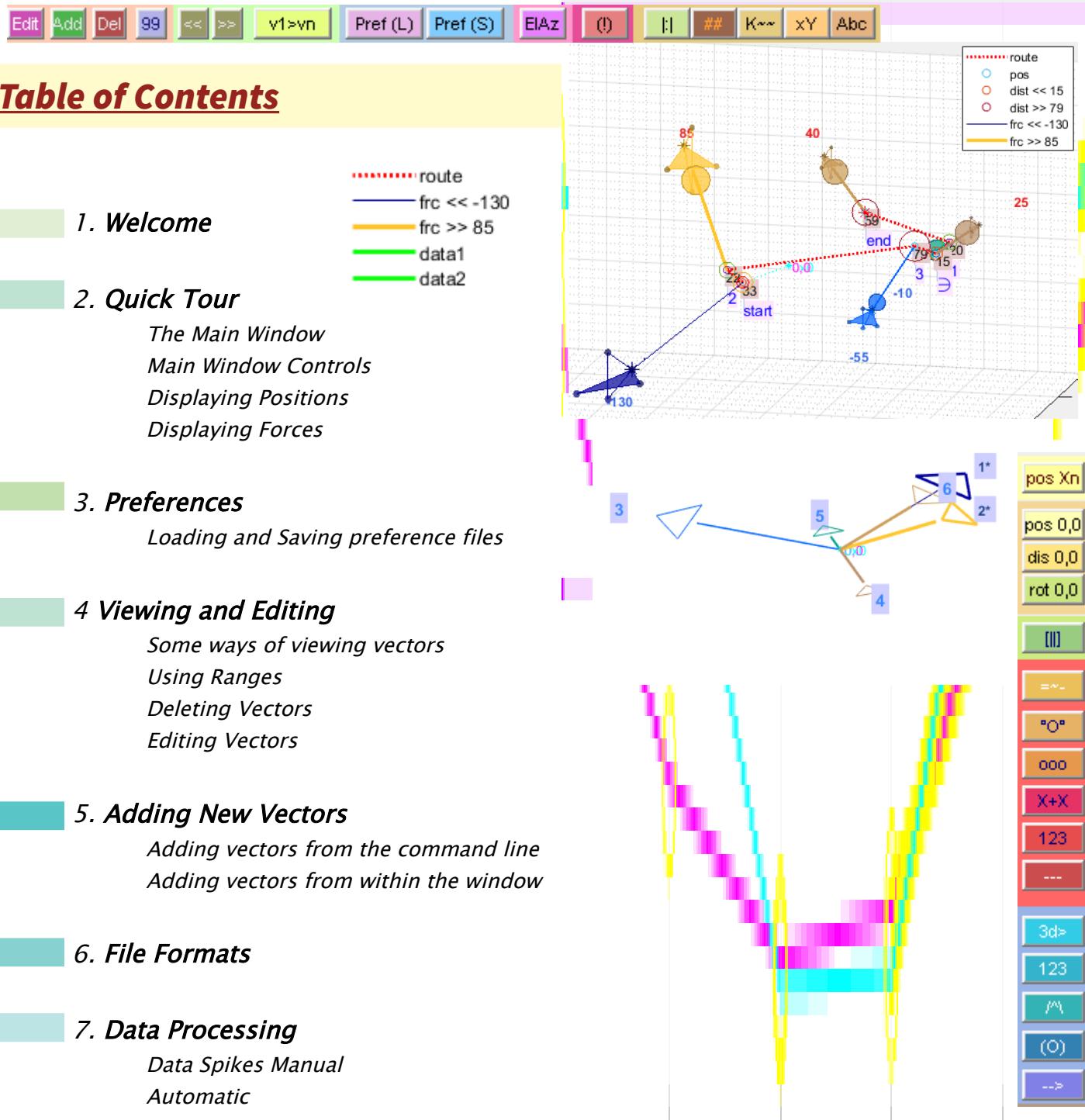
- Focus on a single vector
- List dataset information
- Position direction
- Edit vectors
- Delete vectors
- Add vectors
- Improved file handling
- Split-screen display
- Force chart
- Sort and merge
- Improved data display

Many thanks for everyone at the University of Exeter, the folks at Mathworks and everyone who has encouraged me to progress with this project !

« Dreams come to those who work for them »



Lottie Vectors 2.x User Manual



Appendix 1 – Special characters datasheet

Appendix 2 – Extended special characters datasheet

Appendix 3 – Example vector datasets

Appendix 4 – Version 2.0 command line options

Appendix 5 – Synopsis of the built-in dataset

What Is Lottie Vectors?

Hello there and welcome to the Version 2.0 manual which at the moment is a work in progress but now that I have got 2.0 the program out there on the internet, I can get back to completing it's manual!

This manual though it has begun to have new content for 2.0 still has a few old screen shots and things from the 1.x versions. This will all get fixed soon. I'm going to focus though on adding the new sections for those features that weren't in the previous versions.

There's quite a lot to do ! I hope that the software is proving useful and thanks again for trying Lottie Vectors !

Charlotte Élisabeth Ameil – October 2018

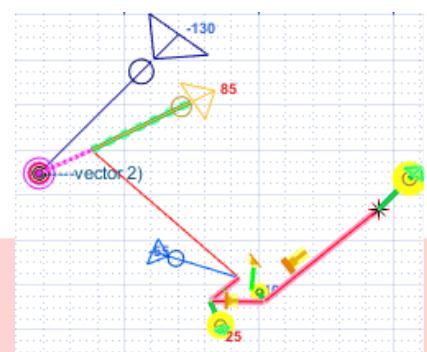
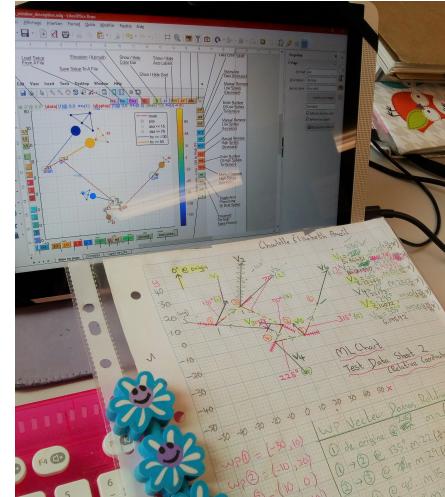
twitter.com/mathlottie

- download the latest version with the filename
[Lottie Vectors.mlappinstall](#)
in 'release_current' at either

https://github.com/lottiemath/lottie_vectors

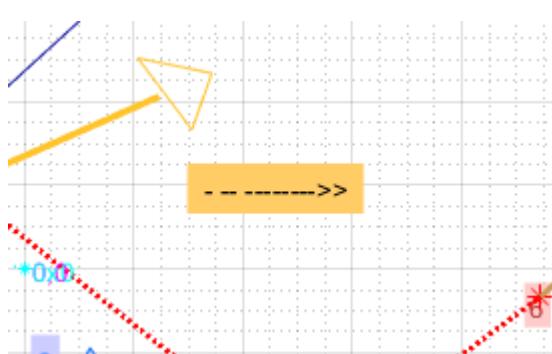
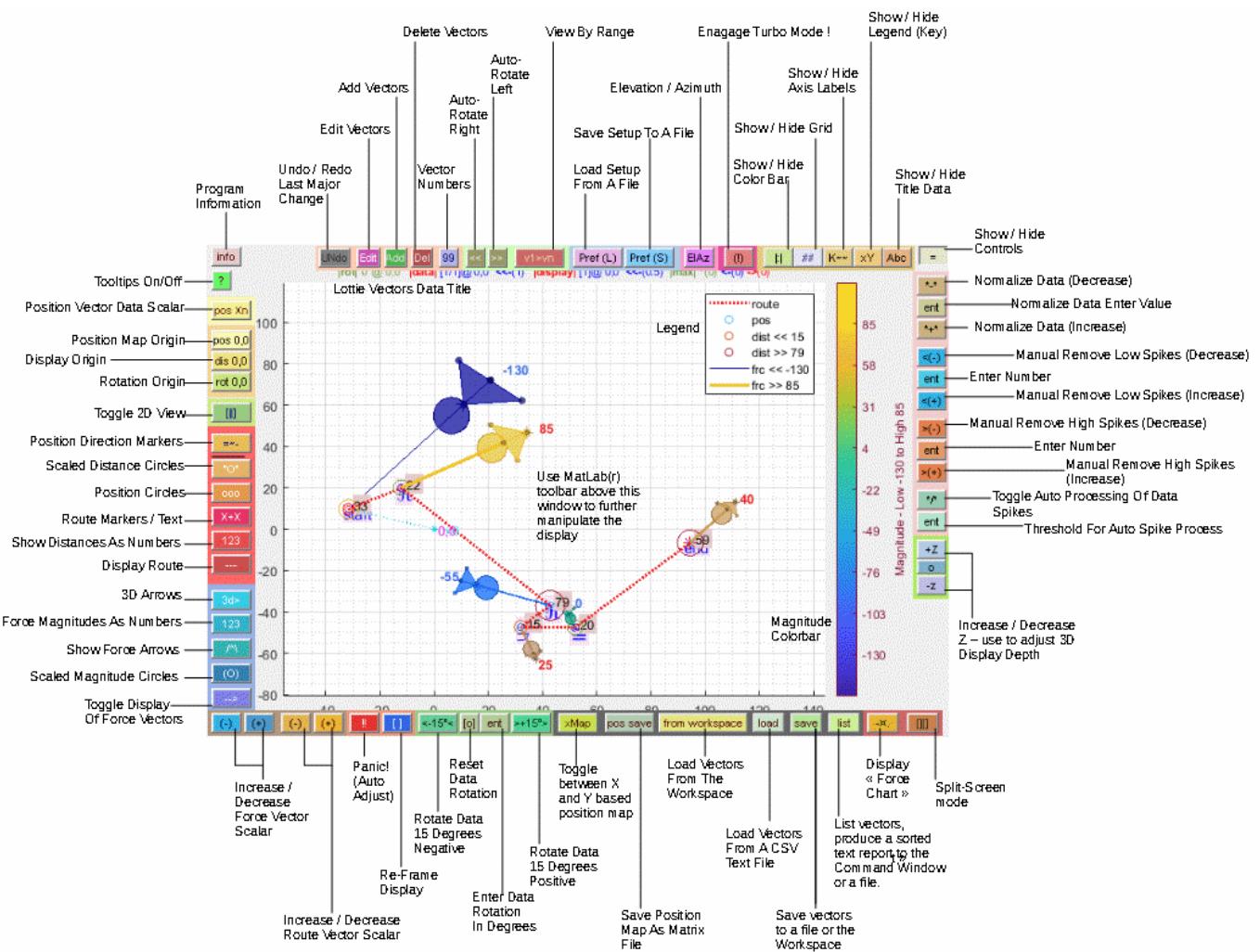
or

<https://sourceforge.net/projects/lottie-vectors/>



Lottie Vectors - Quick Tour Summary of Main Window Controls

The Main Window Buttons

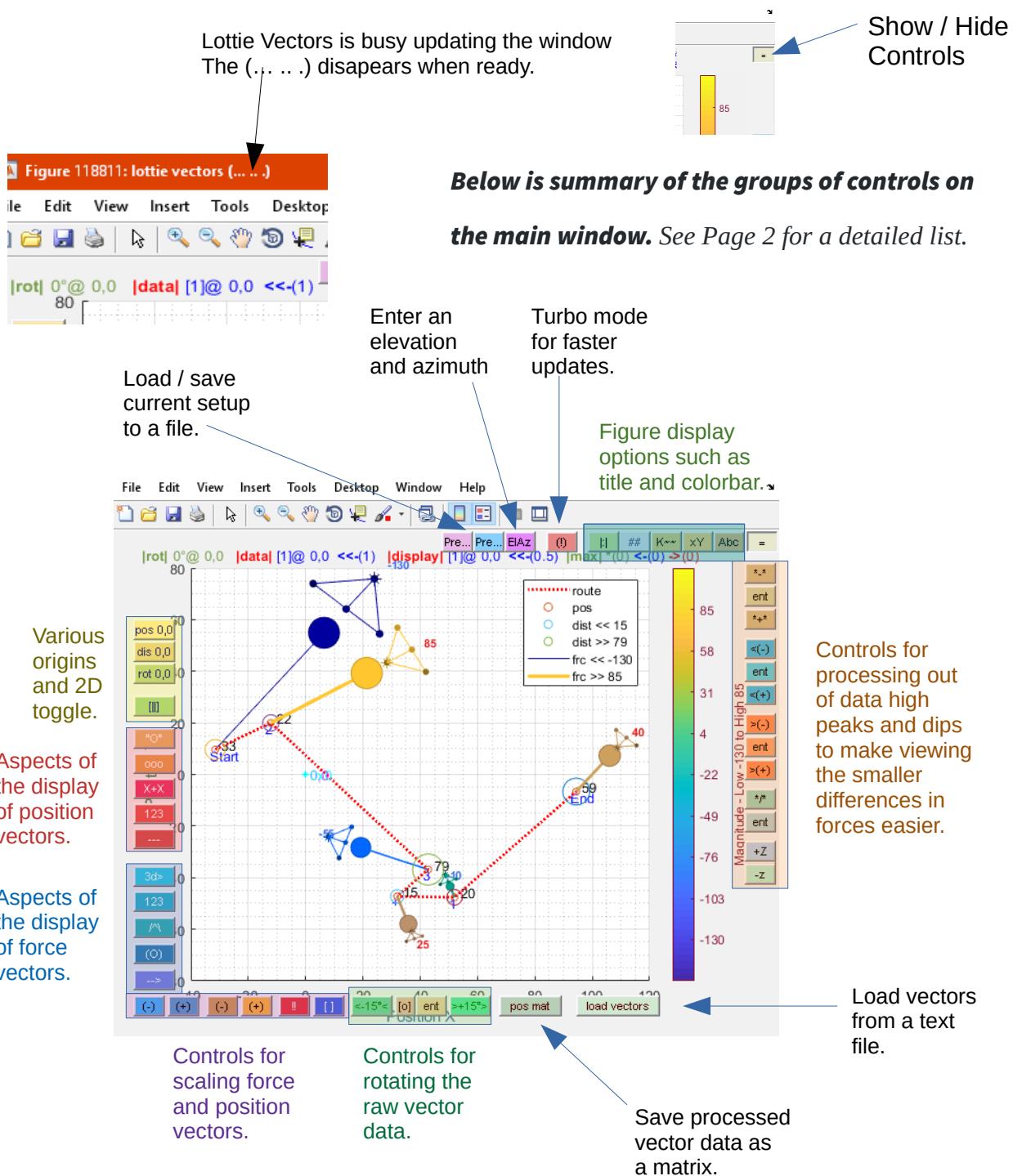


Whenever Lottie Vecctors is busy the border of the window will change color and

Turbo button.

Lottie Vectors - Quick Tour Summary of Main Window Controls

When you start Lottie Vectors it defaults to its built-in demo data. This gives you the chance to work with it right away! However you can load in your own vector data by clicking on the Load Vectors button on the bottom on the window. If you can't see the buttons you may need to undock and maximize the figure window. If there are no buttons around the figure window you'll need to click on the hide/show controls button inside the figure are the top right.

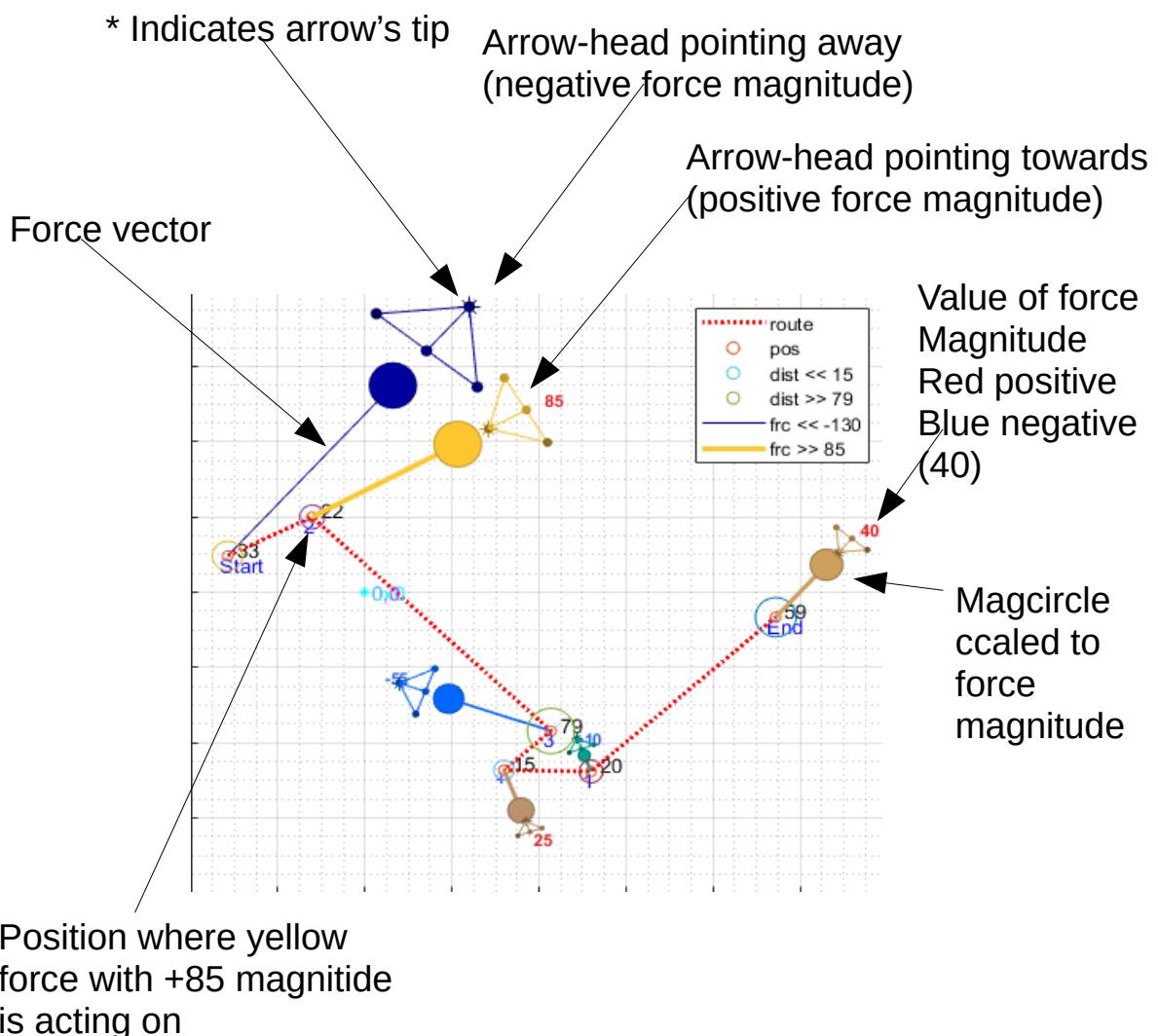


Lottie Vectors - Quick Tour Displaying Forces

The program will try and fit all your vector data on one screen. You can choose to either use the normal methods of zooming in and out from the figure toolbar, or use the program's options. Many of the controls only effect the display of the vectors and not the vector data itself (if you wish to save the position map as a matrix changes such as the rotate buttons will be shown in what is saved).

Descriptions of the display, and what it shows, is given below. You can use the demonstration data at the start to explore.

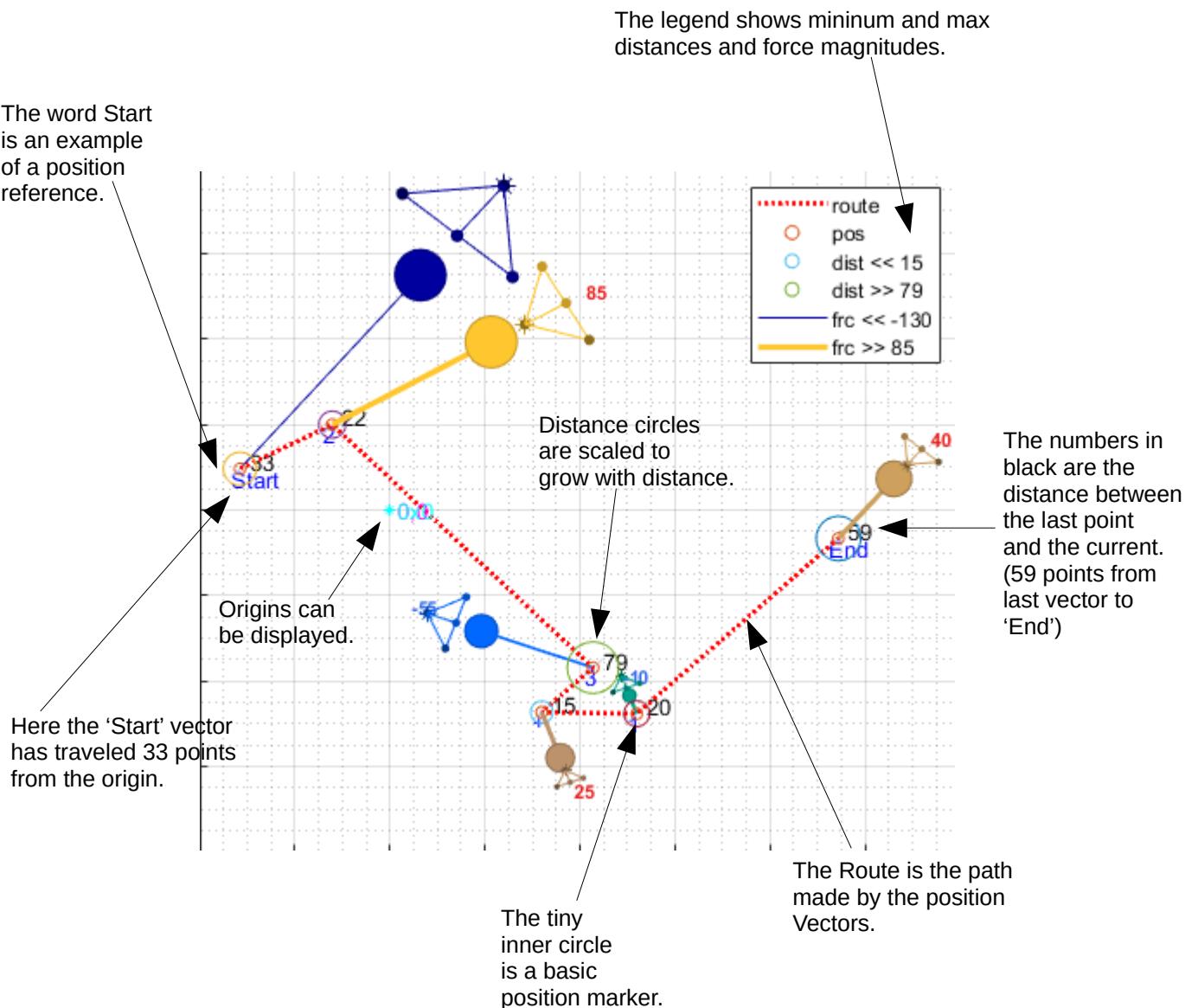
Below shows how force vectors are displayed



Lottie Vectors - Quick Tour Displaying Positions

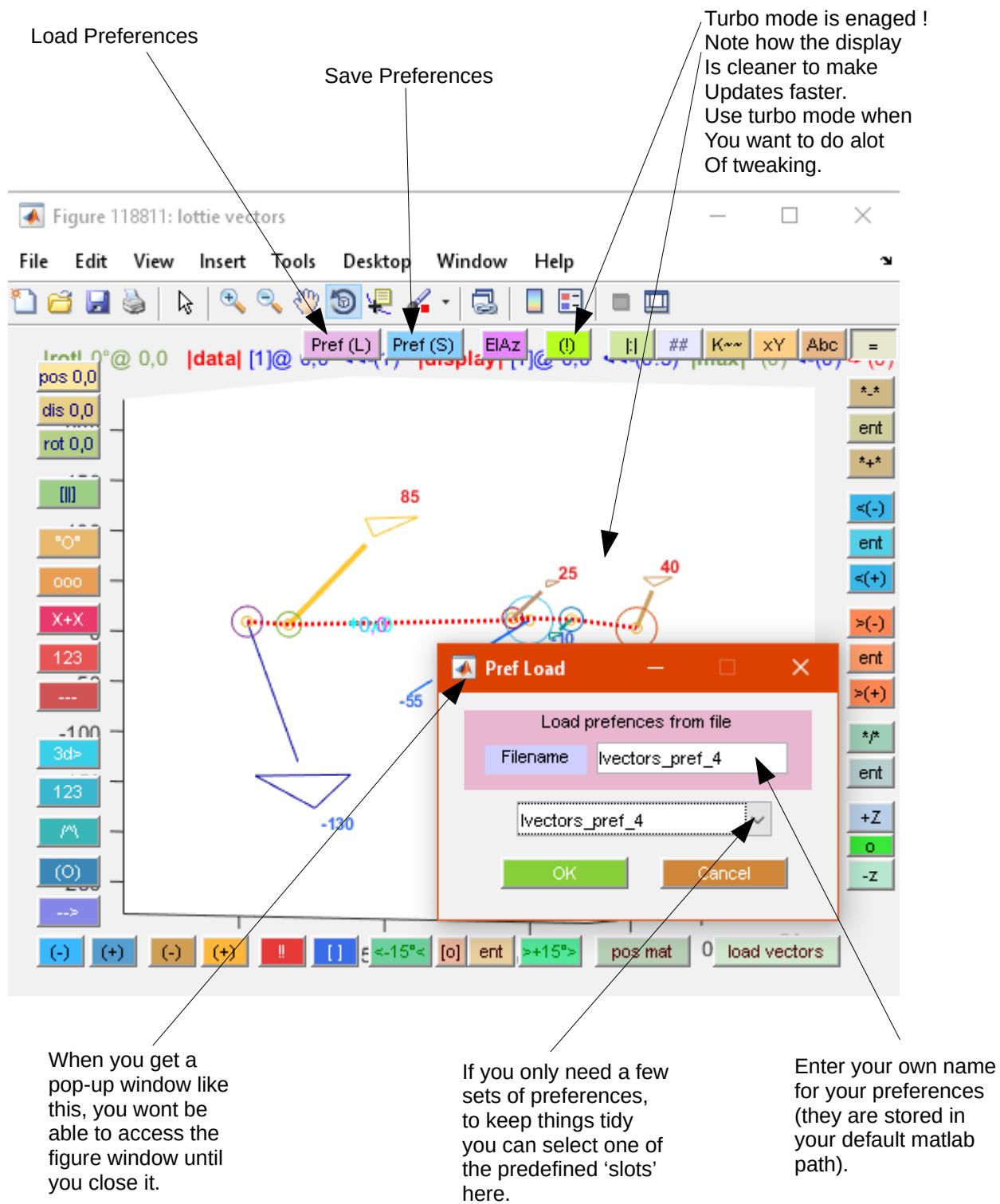
The positions can be displayed and a route mapped, or you can switch off the route leaving something like a vector field with only forces displayed from various positions. I tried to keep the program as flexible as possible so you could end up with some strange combinations !

Below shows how Positions are displayed in the figure window.



Lottie Vectors - Preferences

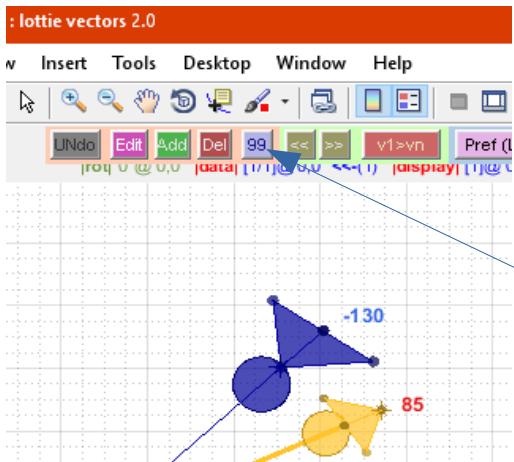
When you have tweaked the display for your vector data you can save the setup in a file and recall it later. You can have multiple files with different preferences which can be loaded in on the main window.



Lottie Vectors – Some Ways Of Viewing Vectors

In this section I'll be giving you more of the quick tour of the buttons and features in Version 2.0 that affect the display of your datasets. We'll be using the built-in set throughout this.

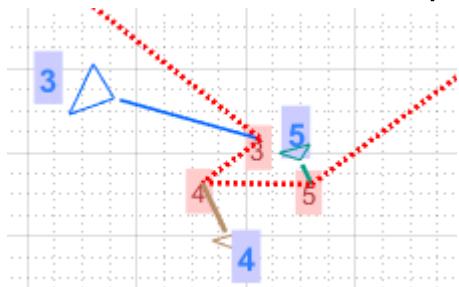
Vectors are stored by their unique number, it's used to edit, delete, copy or view them within ranges. To their numbers will only change when you insert or delete. Simply they are numbered from 1 being the first, or start vector within a route through to the last one in the dataset. Each vector number is assigned to a unique combination of position, force and marker. You can switch the view to show the vector numbers of the built-in dataset by pressing the 99 button.



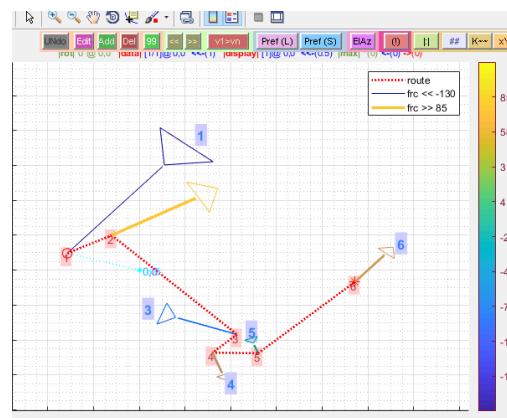
View vectors
by their
vector numbers
(Green is active)

(3) Below we have forces (3,4,5) and positions (3,4,5).

The vector number refers to the pair.



(2) Once pressed the window will update and you'll see the vector numbers, red for the positions, and blue for the forces.



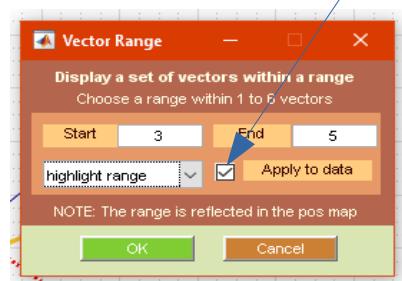
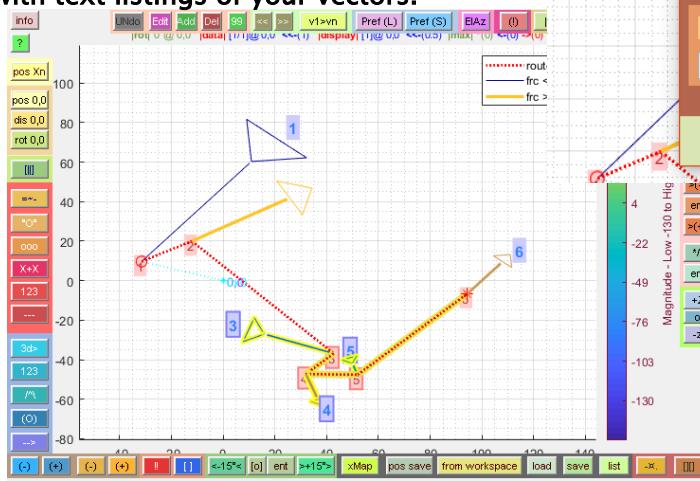
(4) Now that we have the vector numbers on the display we can use them to set a range, click on the range button below to bring it up.



**(5) Enter 3 in the Start box,
5 in the End box, and next
click on the drop-down
menu and scroll down to
select 'highlight range'.**

**Don't forget to check the
'apply to data' box.**

**(6)... And the range of vectors 3 through 5 is
highlighted. TIP : you can also use highlighting
with text listings of your vectors.**



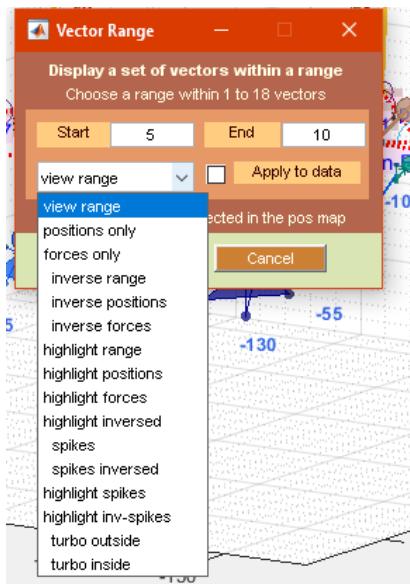
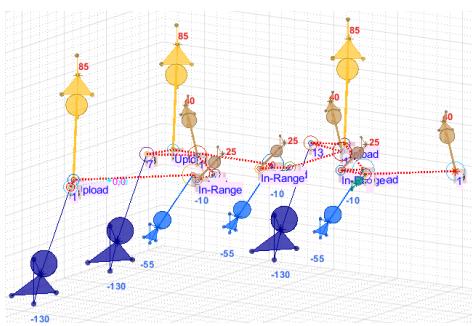
Lottie Vectors – Using Ranges

Now we've tried out the Range button, let's go further and see more about what it can do.

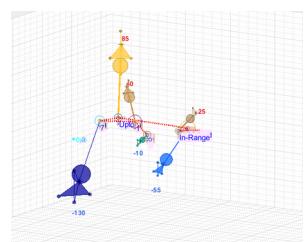
Ranges are great when you need to separate certain vectors through highlighting or perhaps to only display a subset. There are ranges in other functions, but each one is unique and Lottie Vectors remembers your settings (unless you want it to forget them, more on that in the expanded preferences section).

The original dataset with 18 vectors.

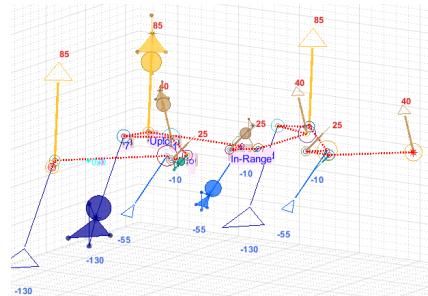
The dataset remains untouched throughout the following examples. Unchecking the 'apply to data' brings everything back.



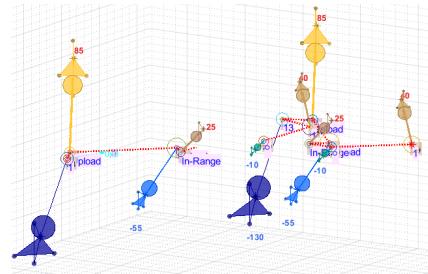
There are a number of different sort options for the Range function. The most simplest is shown below.



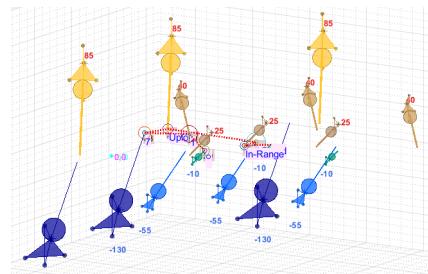
Only vectors 5 to 10 are displayed.



Right is an example of using Turbo in a range. Here of 18 vectors 5 to 10 where selected as 'Turbo Outside', So vectors 1–4 and 11–18 were drawn with less detail. Use this function to speed up displays, but keep the data you're interested in fully drawn.



Again the same dataset and range setting (5 to 10), but this time the 'Inversed Range' was selected. Note how there is a gap in the middle, the dataset has been split effectively into two. Inversed range only drew the vectors outside, the entire dataset is still in place.

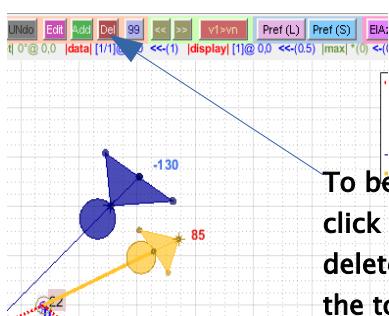


On the right shows the results of the range 'Inversed Forces'. This has only drawn the force vectors from 1 to 4 and 11 to 18, while in the center the red route can be seen where it's been drawn along with the force vectors from 5 to 10.

Lottie Vectors – Deleting Vectors

We're going to look at deleting vectors before we start to edit and add them, as you only need to know the vector's number to delete it. Also many of the principles of deleting are good for adding and editing vectors.

We're going to be using the built-in vector set in this example.



To begin with click on the 'del' delete button at the top of the window.



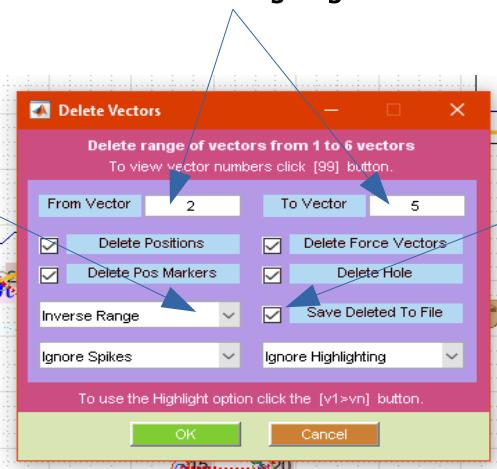
We'll be deleting the 1st and last vectors and then saving them to a file. Sounds complicated? No it's all done in a single step with the use of the options in the Delete Vectors window.

This brings up the Delete Vectors window. If you're using the default dataset, it should look pretty much the same.

It has a range, just like the Range function but like other's it's independent of it.

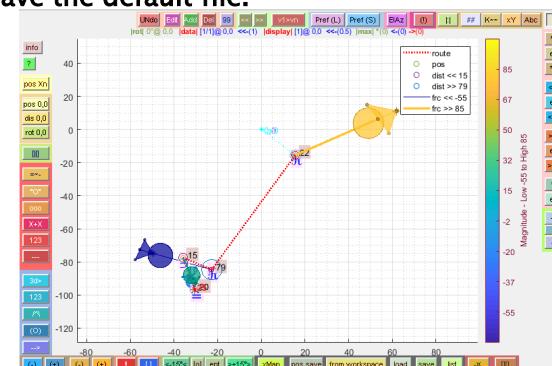
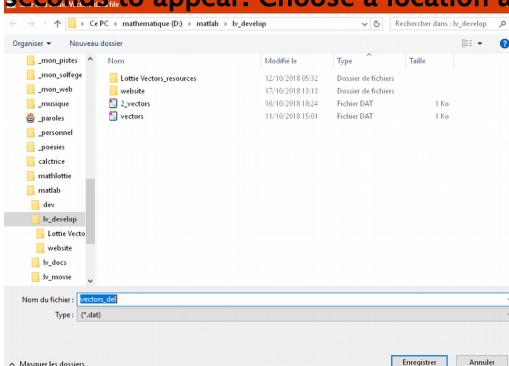
Normally we'd need to know the vector number, but the range is indicated on the top line as 1 to 6 and we only need to delete the 1st and Last. We going to use an Inverse Range so enter 2 and 5 in the boxes.

Open the dropdown menu and select 'Inverse Range'. Instead of deleting 2 to 5, this has selected 1 and 6 to be deleted.



Click on here and we'll have the chance to store the vectors we deleted to a file later.

After clicking on the OK button above, you'll see a save vectors file window pop up. Depending on your computer it may take a couple of seconds to appear. Choose a location and save the default file.



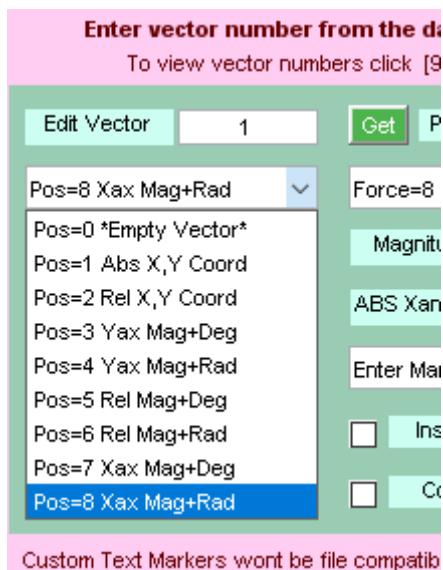
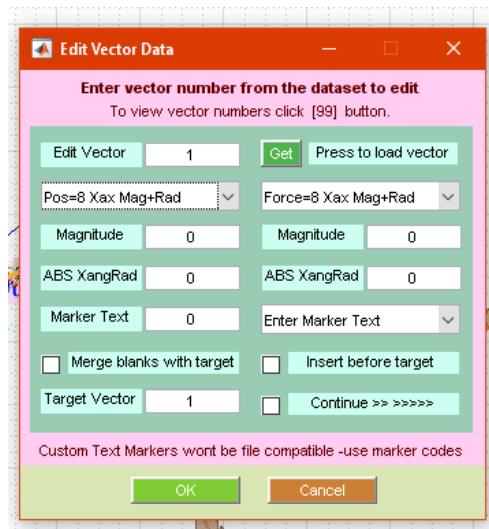
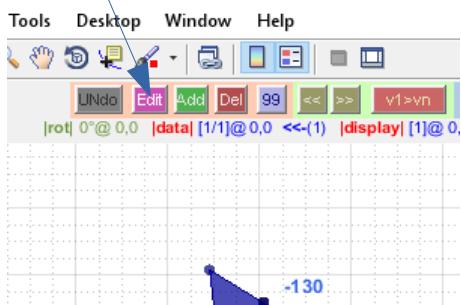
After you've saved your vector file the dataset is reloaded now with the first and last vectors gone.

If you'd like to see the other vectors read the section on loading.

Lottie Vectors – Editing Vectors

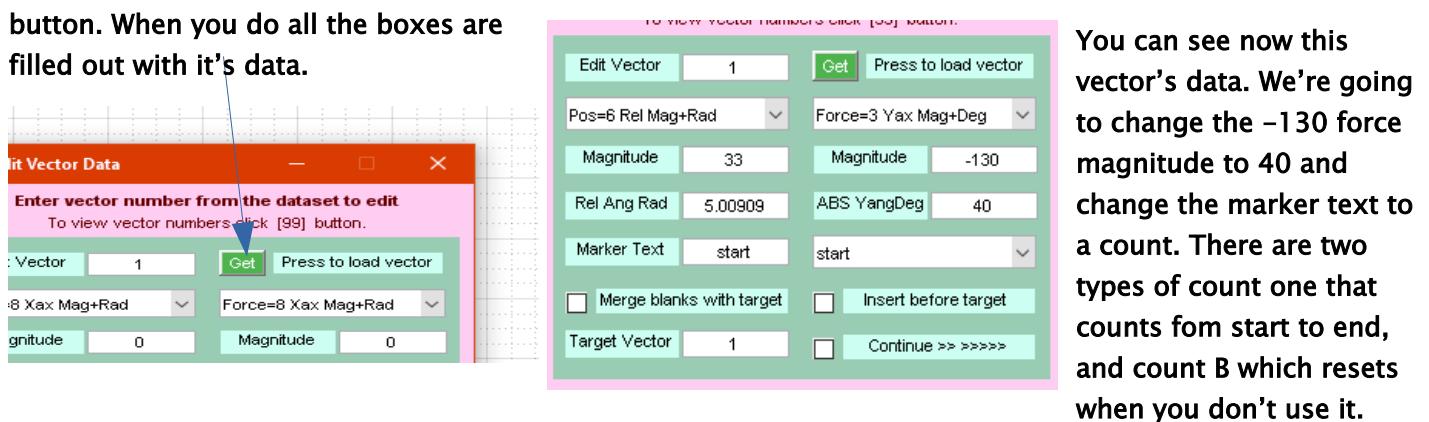
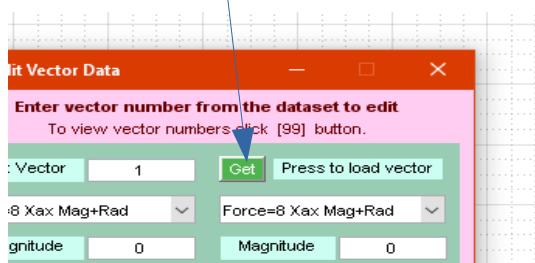
Making changes to a dataset while loaded in Lottie Vectors is also new in version 2.x, here will be looking at the familiar default vector set, and making it less so by putting in some changes of our own !

To get started, bring up the Edit Vectors window by clicking on it's button at the top of the window.



The two dropdown menus at the top have lists of all the possible vector types you can choose from. One set for the position vector on the left and the other for the force vector. You can also create an 'Empty vector', no forces, no position, or neither for that number. This is handy if you want to change a vector in a dataset a number of times in the same place. Leave it blank !

As 1 is in the top Vector box we can 'get' it's information by pressing the button. When you do all the boxes are filled out with it's data.



The Edit Vector Data window has a number of options and fields. Though it may look complicated, it's not much of a puzzle !

The 8 boxes in the middle are all just the same vector data as in a file. The top box is the vector you want to Get information from, the bottom is the Target you want to store to. By default it makes the Target the same.

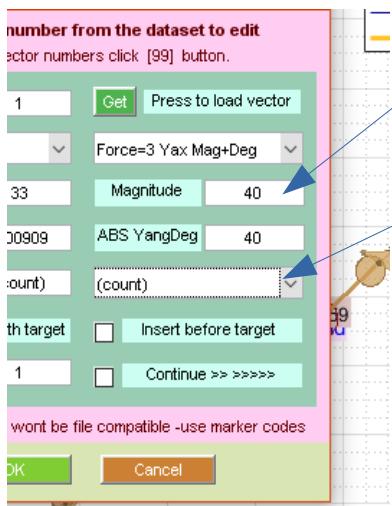
MEMO : (Vector Types)

- 0 = Empty
- 1 = Absolute Cart X/Y Co-ords
- 2 = Relative Cart X/Y Co-ords
- 3 = Absolute Y-Axis Degrees
- 4 = Absolute Y-Axis Radians
- 5 = Relative Degrees
- 6 = Relative Radians
- 7 = Absolute X-Axis Degrees
- 8 = Absolute X-Axis Radians

Tip : Use the preferences to save your favorite vector types in your startup preferences.

You can see now this vector's data. We're going to change the -130 force magnitude to 40 and change the marker text to a count. There are two types of count one that counts from start to end, and count B which resets when you don't use it.

Lottie Vectors – Editing Vectors (continued)



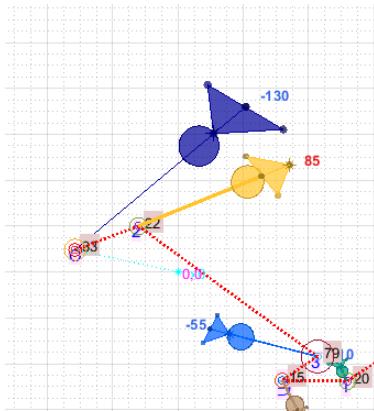
Enter the new 40 magnitude for the force vector here.

Click on the dropdown menu and select (count) from the list.



These options are all about where the vector will be stored. By default, the target is the same as the vector you Get. Inserting before the target will create a new vector adding it to the dataset. Merging will not overwrite any blank or '0' (zero) value fields with the target, keeping its originals. While clicking on Continue will bring up a new window so you can go on editing after this one.

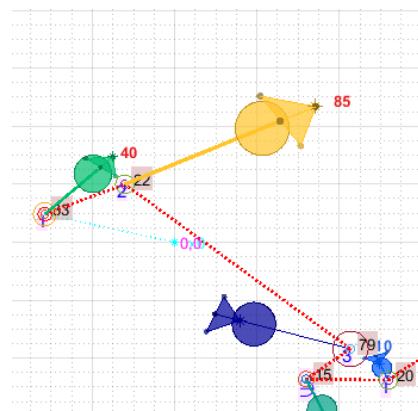
Here we have the dataset before the edit. The -130 is in blue.



Here we have cleared away some of the clutter on the display so it's easier to view the position markers.

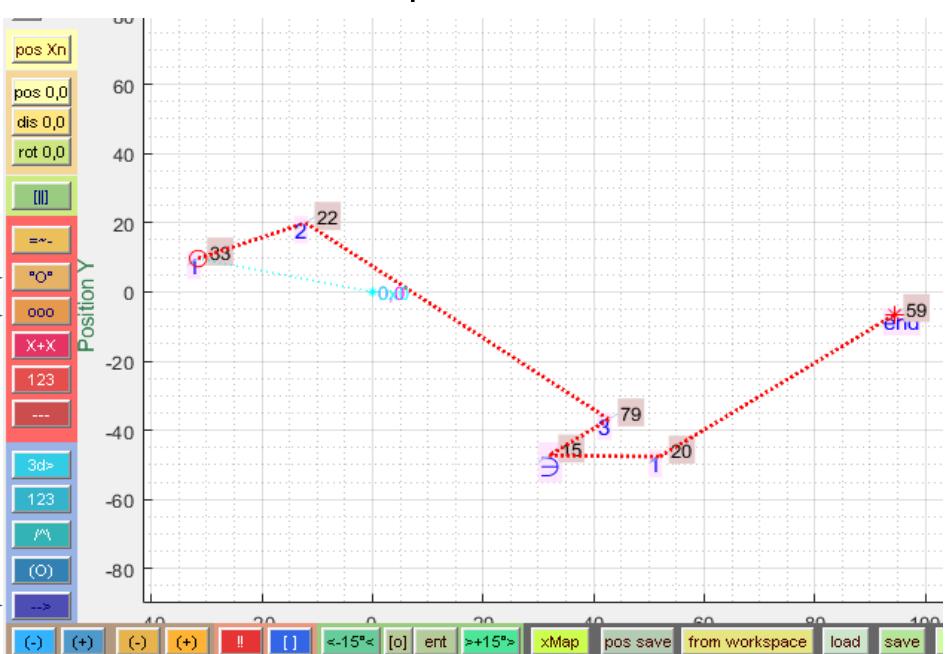
To do this we simply clicked on the 3 buttons with arrows.

Also shown on the display are the distance numbers in brown boxes. Remember they show the distance to their point. So the first vector's distance is 33 from the origin.



And this is the outcome to the dataset after the changes. Because of the reduction in the magnitude the force has now changed color from deep blue (because it was one of the lowest), to green. The arrow on its end has also changed direction from pointing towards it, signifying a negative value, to pointing away because it is not positive 40.

The marker number '1' is just below the position circle in blue.

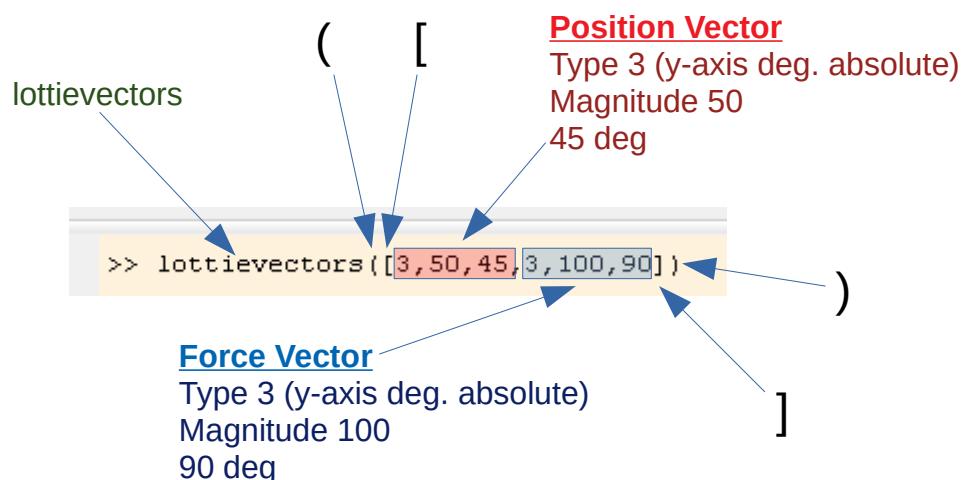


Lottie Vectors – Entering Vectors On The Command Line

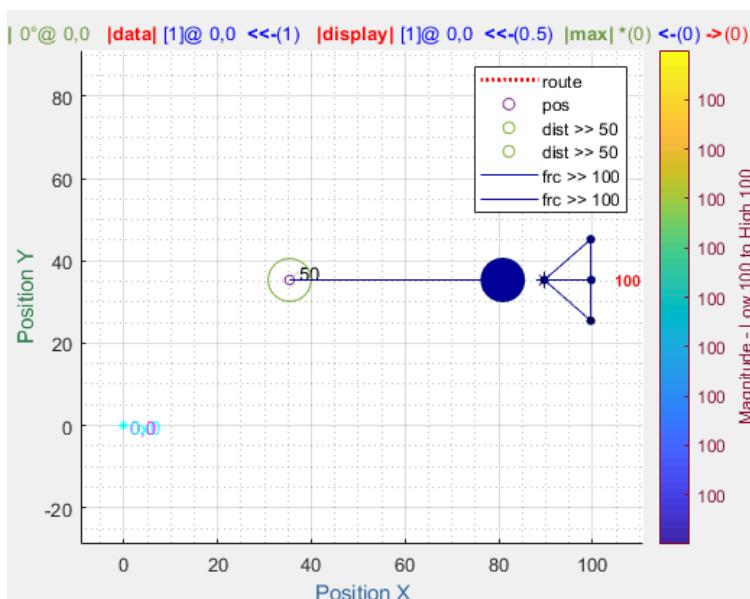
There are a few different ways to pass vectors to Lottie Vectors. You can do so at the command line, either as a variable or in [] notation. Or you can create a text file, give it a .dat extension and write your vectors in that.

To see how files are formatted take a look at the next section. We start with simply entering variables on the command line.

If in Matlab(r) command window you simply enter lottievectors() the figure is displayed with the demo data shown. You can load a blank window by entering lottievectors([0]), or if you want to enter your own vectors at the start use the format below



This will display the following window :



Note that the window has been scrolled with Matlab(r) hand tool to show the origin in blue at the bottom left of the display.

What is seen here is a starting position vector that traveled at an angle of 45deg and a magnitude of 50 from the 0x0 origin in blue. The 50 shows the distance, the larger circle is scaled also to show this.

From this position vector a force vector is drawn at an angle of 90deg and with a magnitude of 100. Because the magnitude is positive by default the arrow points towards the position. The filled blue circle on the force vector is scaled by its magnitude.

Lottie Vectors – Entering Vectors Through the Workspace

The format for vectors is always the same no matter if it's by the command line, within a file, or with the next method as a variable in the Matlab(r) workspace.

There are some advantages to entering your vectors as variables. One you can use Matlab(r)s tools to view and edit the variable on screen as in a spreadsheet. This saves the need for editing in a text word processor. Others include, you can save them, give them directly on the command line, possibly calling up lottievectors from a program. You can also load in many sets of vector data and display them without going through files each time.

The downside is that unlike a text file, the variables are not normally readable in other programs. So could also write text vector files on other devices, and import them from other sources.

From the Matlab(r) prompt type

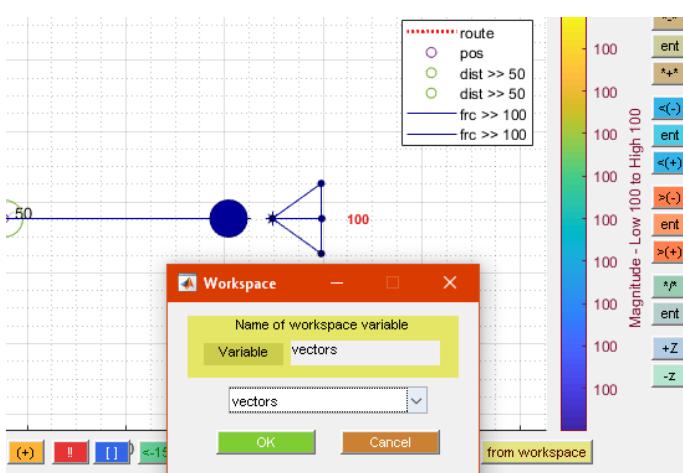
```
>> mat=[3,50,45,3,100,90]
mat =
    3      50      45      3     100      90
fx >>
```

Here you have just defined a matrix 'mat' with the row 3,50,45,3,100,90 these are the same two vectors as before.

Because they are now stored the workspace, you can process them as any other variable and of course you only need to give the command lottievectors(mat) and

```
>>
>> lottievectors(mat)
ans =
    Columns 1 through 12
    35.3553   35.3553   50.0000   45.0000   45.0000     0     0     0     0     0     0   35.3553
          0       0       0       0       0   100.0000  100.0000   90.0000   45.0000  100.0000   0.0000     0
    Column 13
    35.3553
          0
```

is displayed along with the window as before. I've included the position map here because by default it's always given just before the vectors are displayed. More on the position map later. But the numbers which are lower in the columns preceeded by 0 at the top are the force vectors. The position vectors are all in the top row. The reason for this is that before a force vector can be, it's needs a position to act on.

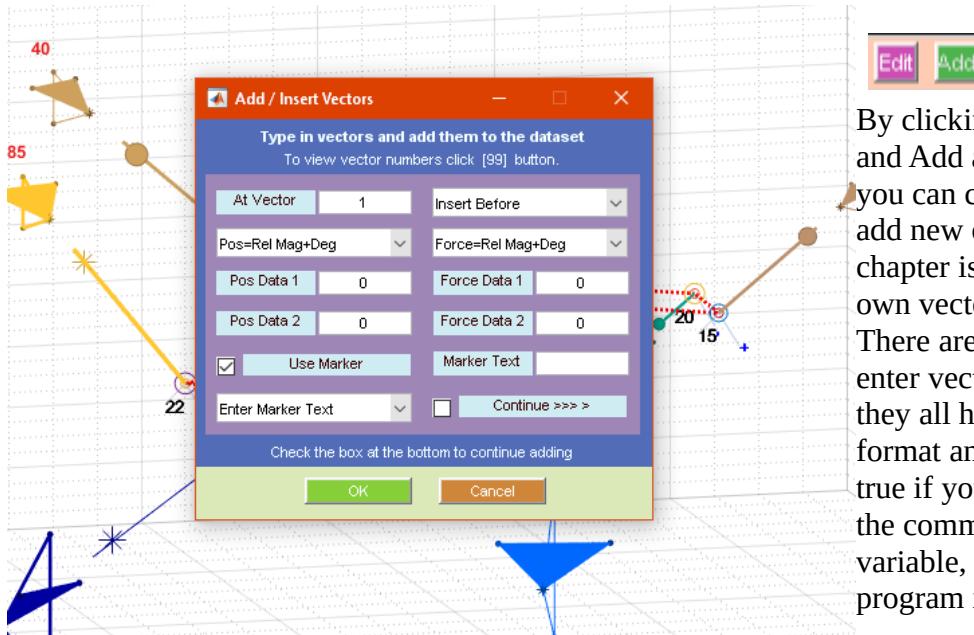


You can also load workspace variables from the main window by clicking on the 'from workspace' button in mustard color at the bottom right of the display.

You are asked to make a selection from the following possible names of variables in your workspace to use. **vectors, vectors1, vectors2, vectors3, vectors4, m , mat, or ans**

Lottie Vectors – Adding new vectors within the window

LottieVectors 2.0 represents a big improvement on the previous releases, with a lot more features and it being more stable. The largest change you'll notice though is the ability to add and edit vectors within the window.



By clicking on the buttons Edit and Add at the top of the display you can change current vectors, or add new ones to the dataset. This chapter is all about creating your own vectors and saving them. There are many different ways to enter vectors into the program, but they all have the same basic format and structure. This holds true if you are entering them on the command line, through a variable, a file, or within the program itself.

If you're not familiar with a lottie vector one is shown below

6 20 300 6 50 90

It's a repeating format that uses numbers and spaces within a text file. Each line is a new vector. A vector in LottieVectors can be a 3 part thing, and these are a position, a force and a marker. No text is allowed in the files, which are standard CSV format and are easy to transfer via email or messages. Don't get these files confused with Listings, those are looked at in another chapter.

When entering vectors within the program, the display will update on each vector you add or edit. It's recommended that you set Turbo mode to on for a faster response. You might also like to click on the [99] button which enables you to see the vector numbers on screen. Use these vector numbers to choose either the vector to edit, or the point within the dataset you want to add new vectors at.

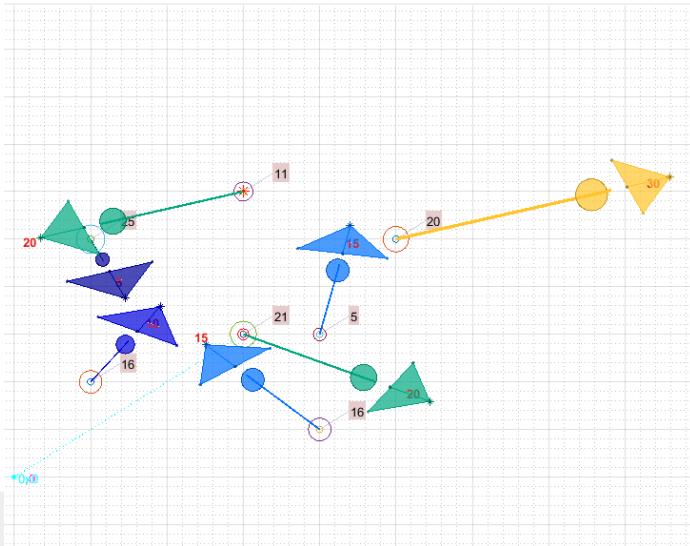
You can also make use of Ranges and Highlighting which you may find helpful in keeping track of where you are in the process of editing. Features such as the List button also give you more information in a text format about the dataset, as well as an easy to read table of what's currently there. You can save listings as a text file, use a notepad like utility to display the file onscreen while editing.

Finally make use of the display schnauzer buttons around the edge of the window to keep down the clutter on the display and show just what you need. Zooms are automatic when display within only a selected range, use this function to blow up a small area of your dataset to make viewing while editing easier.

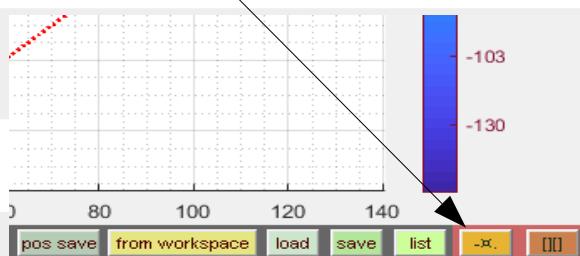
Lottie Vectors – Using Vector Fields

As well as vectors that have positions making up a route, you can also display vector fields. These are separate vectors which have a position, a force magnitude, and a direction for that force. The difference is in how you specify the position of the vector. With vector fields you generally use X, and Y coordinates. Although in actual fact you could still use another vector to specify the position, absolute coordinates provide a fixed position typically data from a map of points and their forces.

This is a sample vector field which is included as a demonstration vector file. It's output is shown below.



You can display all force vectors on their own in any kind of dataset using the field chart button.



You can use all the standard functions with force charts. Here the 99 button is active showing the vector numbers, and a range between 3 and 7 has been highlighted.

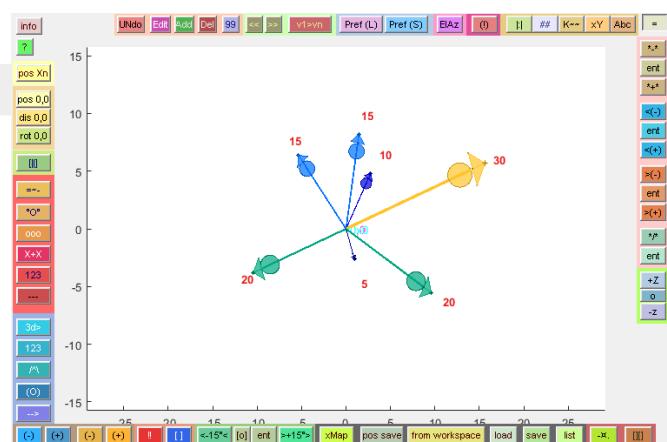
It's encoding is given here.

Note the first number being a 1 denotes that the following two are X and Y absolute coordinates respectively.

```
1 15 15 3 20 120  
1 20 15 3 15 10  
1 5 10 3 10 30  
1 20 5 3 15 320  
1 5 25 3 5 160  
1 25 25 3 30 70  
1 15 30 3 20 250
```

What follows the coordinates is a regular force vector in degrees absolute from the Y axis. This is how you can make up a vector field. And when you specify a format such as this, Lottie Vectors recognizes it as a vector field and switches off the route indications by default.

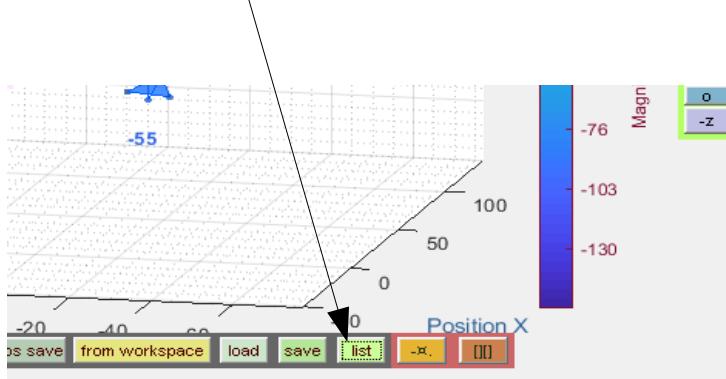
This shows them from a central point, so you can compare their magnitudes and directions with each other easier.



Lottie Vectors – Creating Listings Part 1

Lists are not only a way to produce text files which make examining vector data easier, they are also a powerful way to sort and extract certain vectors from a large dataset.

To bring up the List Vectors window click on the List button at the bottom of the window.

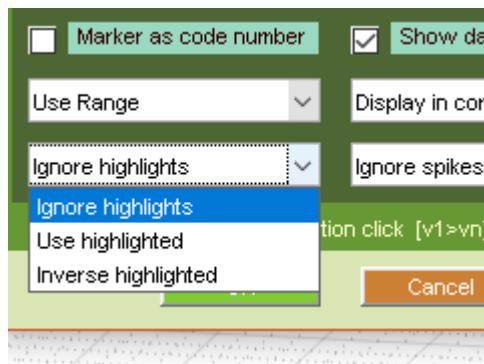
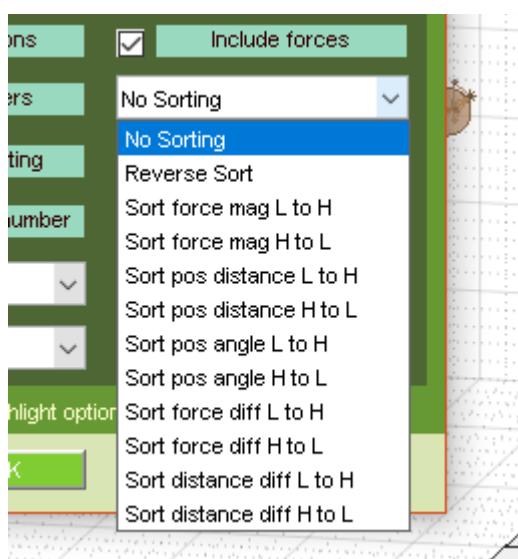
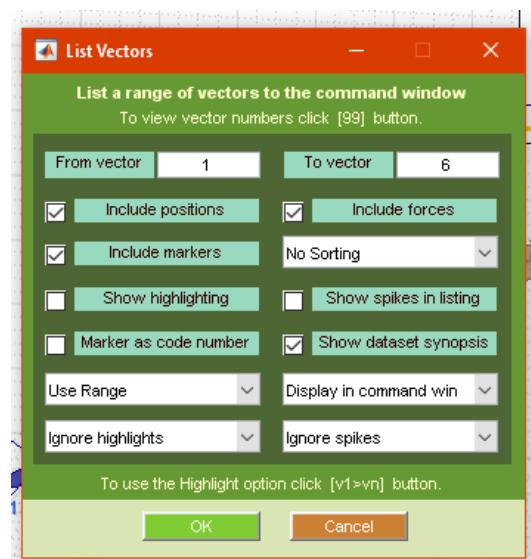


There is also a large section for various sorting options. Because it's a text list, these help readability by organizing your vectors from various points of interest.

Combine the sorting from this window along with highlighting specified from the Range window to further customize the output.

You can produce a list of all vectors and choose to have the highlights and spikes indicated in it.

The List Vectors window has the familiar sub-range, along with options for picking up on other processing, like highlights and spikes .



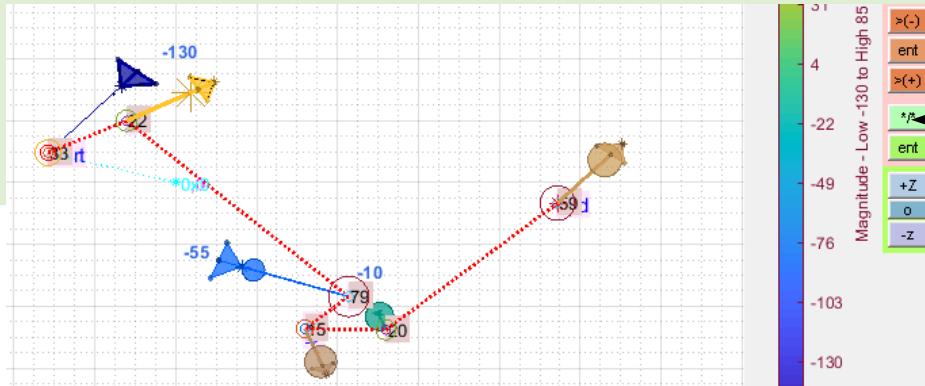
There are a range of output options for the listing. You can either have it displaced in the command window, save it as a text file, or turn it into a vectors.dat file or a workspace variable.

You can also use the list as a new vector dataset in the window.

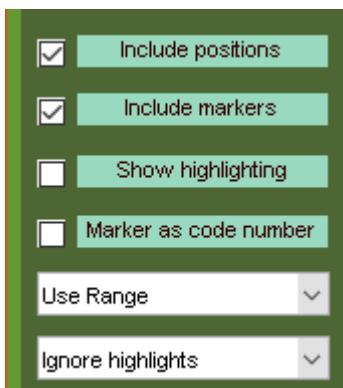


Lottie Vectors – Creating Listings Part 2

In this section we will be creating a listing showing the data which the auto-process has cut, leaving out the first vector, and sorting in descending order of magnitude. We'll be using the built-in dataset and outputting to the command window.



Make sure the **Include forces** boxes is ticked, and then in the sort dropdown menu below select **Sort Force Mag H to L**. This sorts the list according to the magnitudes from high to low.



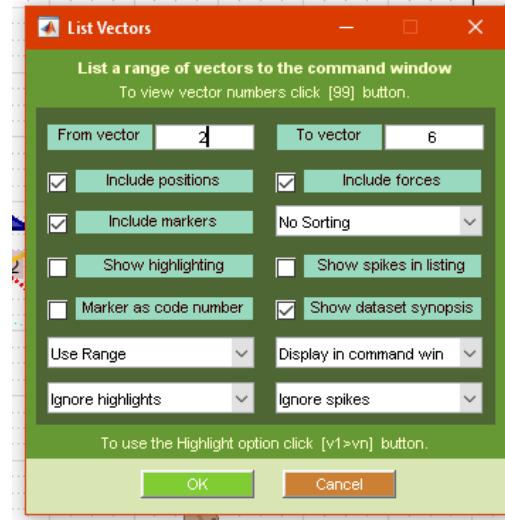
On the left hand side make sure the **Include Positions** and **Include markers** boxes are checked. You'll need to Use Range to cut the first vector, and Ignore Highlights. Marker as code number, gives the file code for markers.



Check the box **Show Spikes** On Listing on the right hand side fo the window. The show dataset synopsis gives extra infromation on the listing at the top of it. You'll need that checked, Display in Command Win selected and to Ignore Spikes (otherwise they will affect what is listed)

To begin enable the process spike auto cut by clicking on the button at the right side of the window.

Bring up the List Vectors window and enter a 2 in the From Vector box.



```
--Synopsis--
Force, Mag Nat MAX= 85.0000 (vector 2) MIN= -55.0000 (vector 3)
Force, Mag Abs MAX= 85.0000 (vector 2) MIN= 10.0000 (vector 5)
Force Total = 110.6218 : |Total| = 220.8283

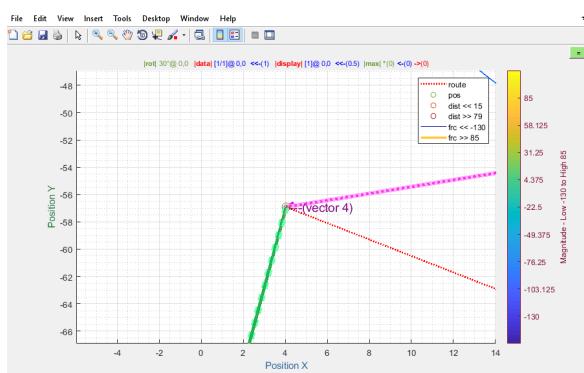
Position, Dist MAX= 79.0000 (vector 3) MIN= 15.0000 (vector 4)
Position, Angle MAX= 315.0002 (vector 6) MIN= 73.9998 (vector 3)
Position Distance Route = 195.0000 : Direct (1 to 5) = 101.2598
Position Plane Dimensions = (-12.1334, -47.6193) to (94.3931, 19.9767)
Position Plane Area = 7200.7569 : From vectors (2, 5) to (6, 2)

Position Vectors [6] (Rel Mag+Rad) = 5 : 100 %
Force Vectors [3] (Yax Mag+Deg) = 5 : 100 %

Legend : * = Spike
=====
vnnum : Position (Type, Data, Data) : Force (Type, Data, Data) : Marker
=====
2 : Rel Mag+Rad (22, 2.3562) : Yax Mag+Deg (85, 60) *: (count)
. Rel Mag+Rad 59, 5.4978 . Yax Mag+Deg 40, 40 . end
4 : Rel Mag+Rad (15, 1.5708) : Yax Mag+Deg (25, 160) : ni
. Rel Mag+Rad 20, 3.927 . Yax Mag+Deg -10, 340 . (count B)
3 : Rel Mag+Rad (79, 1.2915) : Yax Mag+Deg (-55, 290) : (count)
=====
```

Click on the OK button and the above output is displayed in the command window. This information can also be saved as a text file.

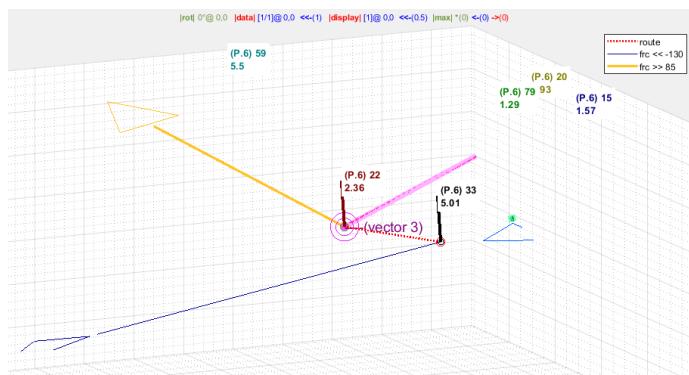
Lottie Vectors – Focussing on a particular vector



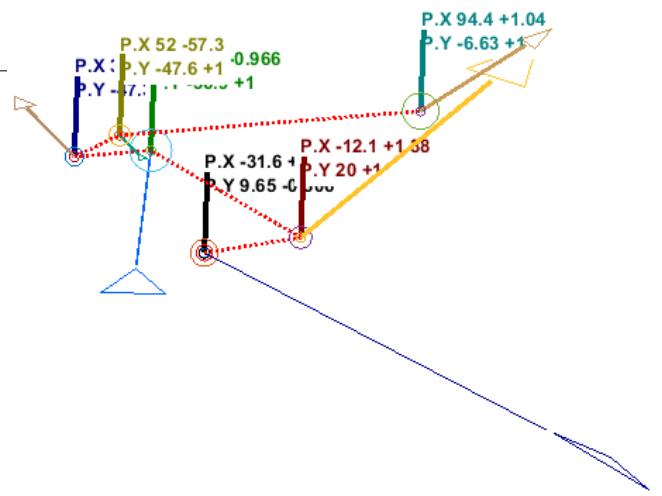
This feature allows you to pick out just one vector on it's own, and move the display so it is in the center of it. You can also choose to zoom in on it's position, and highlight it, independent of any other highlighting or range. Note, the the display remains focussed on this vector until you enter a 0 to switch the feature off.

The results of this are shown in the window on the left. Show Controls has also been disabled to make the display clearer. While in focus, use MatLab(r)'s hand tool to explore the area where the vector is.

Combine the Focus option with others such as the 99 ‘Information’ button described on the following page, along with the options to edit what data is displayed to have just what you need in the window and make things clearer.



Lottie Vectors – Displaying vector information with the dataset



Lottie Vectors – File Formats

```
=====
Example 1
=====
(Position vectors only with refences)
<
33, 288, 1
22, 63, 0
79, 134, 0
15, 228, 3
20, 90, 4
29, 43, 2
<
<
```

By default the filenames location is wherever MatLab(tm) looks for files, this is probably the directory you loaded Lottie Vectors from. You can load in vectors right from the window, just click on the Load Vectors button at the bottom. If you cant see the button you may have to undock the figure window to get to a size where all the buttons are available.

The format of the file is CSV. This means there is only numbers sperated by commas, and no text. Save the file in .TXT format, use a text editor like Notepad to create the files.

Lottie Vectors regonizes a few different types of file and each is listed below. The reason for different types is to help speed up entering vectors. Each format adds another field giving you more flexibility in the type of data you want to use.

- **Format 1**

Simple Magitude and Degree Vectors

1 Magnitude of position 2 Degree of position 3 Magnitude of force 4 Degree of force

- **Format 2**

As format 1 but with a reference number at the end (see a later page for what the reference numbers display).

- **Format 3**

1 Position vector type 2 Position vector data 1 3 Position vector data 2 4 Force vector type 5 Force vector data 1 6 Force vector data 2

- **Format 4**

As format 3 but with a reference number at the end

Lottie Vectors – File Formats Continued

A typical vector data file looks like the listing below

6, 33, 5.00909, 3, -130, 40, 1

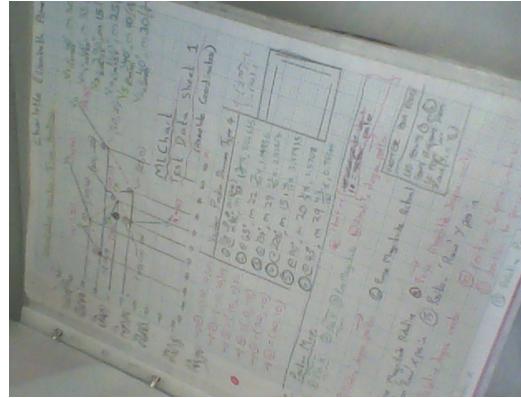
6, 22, 2.35619, 3, 85, 60, 5

6, 79, 1.29154, 3, -55, 290, 5

6, 15, 1.57080, 3, 25, 160, 7

6, 20, 3.92699, 3, -10, 340, 8

6, 59, 5.49779, 3, 40, 40, 2



Each line has the data for two vectors. The first is the position vector, and the second as a force vector. The format shown contains all the fields that could be used in a file.

The first column is the Vector Type for the position vector, then there is the magnitude, and in the 3rd column it's angle in radians.

The 4th, 5th, and 6th columns repeat the same information but for the force vector.

The final 7th column is a reference number that is shown onscreen. It's number refers to a table of symbols that could be displayed at the position.

Vector Types

There are 8 different Vector Types or ways of expressing them. Some are common, others less so and are more for educational purposes as they are not really vectors !

There are two basic types. The vectors with magnitude and angle, either in degrees or radians. There are also two others where the vector's position is expressed in either fixed, or relative cartesian coordinates.

The Vector Type numbers are listed below and are seen in columns 1 and 4 or the example file above. You can mix types and change them at any point in the data.

List of vector type numbers

0 = ignore vector

1 = vector is a global cartesian coordinate as position

2 = vector is a relative cartesian coordinate to the position

3 = vector is a magnitude first then global angle in degrees taken from the y axis going clockwise

4 = vector is a magnitude first then global angle in radians taken from the y axis going clockwise

5 = vector is a magnitude first then relative angle in degrees

6 = vector is a magnitude first then relative angle in radians

7 = vector is a magnitude first then global angle in degrees taken from the x axis going anti-clockwise

8 = vector is a magnitude first then global angle in radians taken from the yxaxis going anti-clockwise

Lottie Vectors – File Formats Continued Vector References for use in files

The following are the number to displayed results for the vector references in files. This is always the final column. You do not need to specify a reference, but if you do then you need to include one at the end of each line.

0 = nothing is displayed

1 = display the position vector number from the start

2 = display the position number from last text

(resets to 1 on any other input)

3 = start

4 = end

5 = x

6 = X

7 = o

8 = O

9 = a

10 = b

11 = c

12 = A

13 = B

14 = C

15 = i

16 = j

17 = k

18 = l

19 = J

20 = K

21 = alpha (lower case)

22 = beta (lower case)

23 = gamma (lower case)

24 = Alpha (upper case)

25 = Beta (upper case)

26 = Gamma (upper case)

27 = delta (lower case)

28 = phi (lower case)

29 = omega (lower case)

30 = Delta (upper case)

31 = Phi (upper case)

32 = Omega (upper case)

33 = theta (lower case)

34 = lambda (lower case)

35 = sigma (lower case)

36 = Theta (upper case)

37 = Lamda (upper case)

38 = Sigma (upper case)

Examples of vector files

The following are all entered in a basic Word Processor such as Notepad and then saved in .TXT format. When saving files the format might be shown as Raw, ASCII, Text or TXT in your word processor. You can find demo data online. See the back of the first page for web addresses.

By default I chose to use the .dat extension to the datafiles but you can specify a .txt file if the .dat extension causes problems when editing.

Default position only data

100, 45

50,90

25, 180

30, 12

go 100 points @ 45 degrees

go 50 points @ 90 degrees

go 25 points @ 180 degrees

go 30 points @ 12 degrees

Position and Force data

3, 50, 90, 3, 20, 120

6, 100, 3.92699, 1, 50, 40

go 50 points @ 90 degrees
force of 20 points @ 120 deg

go 100 points @3.92699 rad
connect ‘force’to x=50, y=40
(the use of cartesien coordinates here is
obviously not a true vector, but it could be used
for particlar applications of data to be displayed)

Position, Force and References

1, 30, 25, 3, 100, 90, 3

3, 50, 90, 3, -40, 80, 34

go to x=30, y=25

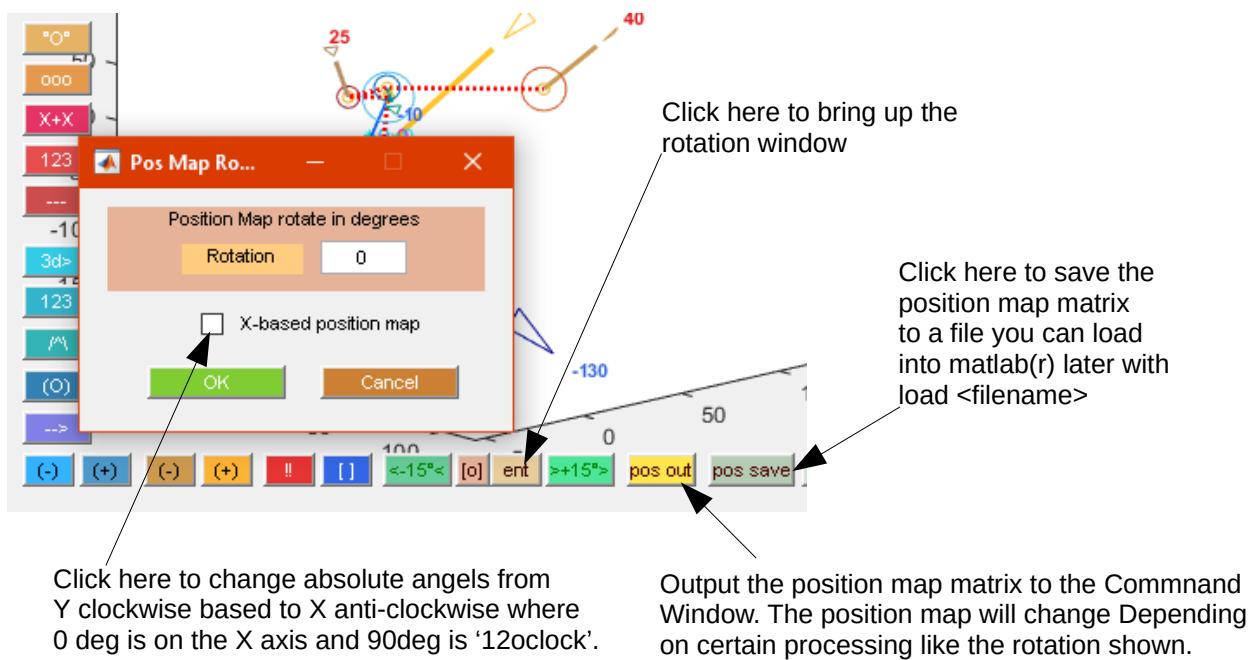
force of 100 points @ 90 deg
display the word ‘Start’

go 50 points @ 90 deg
force -40 points @ 80 deg
display lower-case lamda

Lottie Vectors - Position Map (The Result)

The position map is a matrix of data that Lottie Vectors stores in the Matlab(tm) workspace after computing the vectors.

The data consists of cartesian coordinates of the vectors route, along with forces and copies of both sets of vectors magnitude and degrees. *The default for absolute angles is that they are read clockwise from the Y axis. You can change this by ticking the box on the rotate option.*



POSITION MAP DATA

If you supply a variable to lottievectors when you run it from the command line such as mymat=lottievectors() . Then the first position map will be stored in mymat.

You can open the position map from your main workspace using Matlab's variable viewing tool by typing `openvar` and then the name of the variable, or clicking in it within the workspace browser. A typical position map opened within the variable editor is shown below.

Lottie Vectors - Position Map (The Result Continued)

A typical position map seen through the command window is shown below.

```
position_map =  
Columns 1 through 10  
-31.5581  9.6481  33.0000  286.9997  286.9997          0          0          0          0          0  
-12.1334  19.9767  22.0000  61.9995  134.9997 -20.0000 -38.5437  40.0000  338.0005  12.8558  
 42.7454 -36.8505  79.0000  135.9993  73.9998  85.0000  105.5644  60.0000  284.0007  73.6122  
 31.9554 -47.2704  15.0000  225.9995  90.0002 -15.0000 -21.5754  290.0000  64.0005 -14.0954  
 51.9524 -47.6193  20.0000  90.9994  225.0000  25.0000  33.9590  160.0000  69.0006  8.5505  
 72.8131 -27.4740  29.0000  45.9996  315.0002  10.0000  14.0674  340.0000  294.0004 -3.4202  
          0          0          0          0          0          30.0000  52.9813  40.0000  354.0004  19.2836  
Columns 11 through 13  
 0 -31.5581  9.6481  
15.3209  19.4247  10.3286  
42.5000  54.8788 -56.8271  
 5.1303 -10.7900 -10.4200  
-23.4923  19.9970 -0.3488  
 9.3969  20.8607  20.1452  
22.9813          0          0  
  
=
```

If you process data later on within the program you'll need to save it from there. However you can also use the save startup prefs to store all your changes, quit the program, then run again as mymat=lottievectors() and the program will perform your processing and store the results in mymat.

HOW POSITION MAP DATA IS FORMATTED

Shown below are the columns in the matrix and their meanings. If you don't have any force vectors then lottievectors automatically removes them so you end up with a 6 column matrix instead of a 13. The force vectors are easy to tell apart from the position vectors as they all start one row below the position vectors and so have zeros on the first row for their columns.

- Column 1 : Position X Coordinate
Column 2 : Position Y Coordinate
- Column 3 : Position Magnitude
- Column 4 : Position Degree Absolute (Where 0 degree is x=x y=+inf)
Column 5 : Position Degree Relative (Where 0 degree is direction of last heading)

Column 6 : Force Magnitude Absolute

Column 7 : Force Magnitude Relative (Relative to force's direction with last heading and position magnitude)

Column 8 : Force Degree Absolute (Where 0 degree is x=x y=+inf)

Column 9 : Force Degree Relative (Where 0 degree is direction of last heading)

Column 10 : Position to Force vector tip X Coordinate

Column 11 : Position to Force vector tip Y Coordinate

Column 12 : Position relative X Coordinate (relative from the last position)

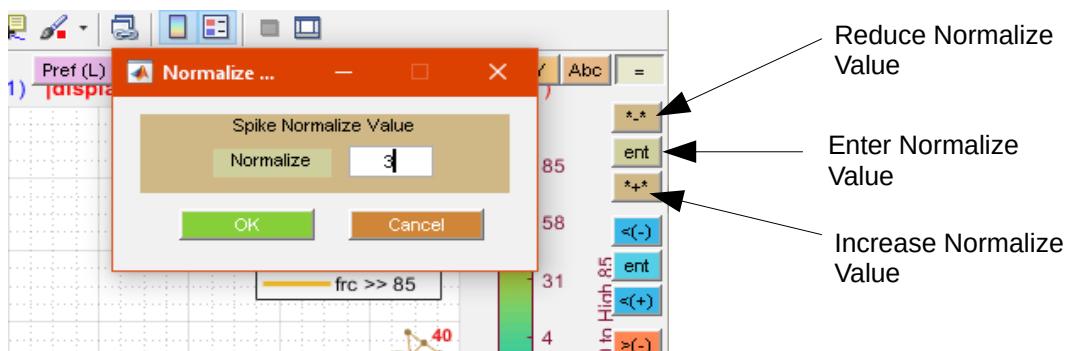
Column 13 : Position relative Y Coordinate (relative from the last position)

Lottie Vectors - Data Processing / Smoothing Spikes

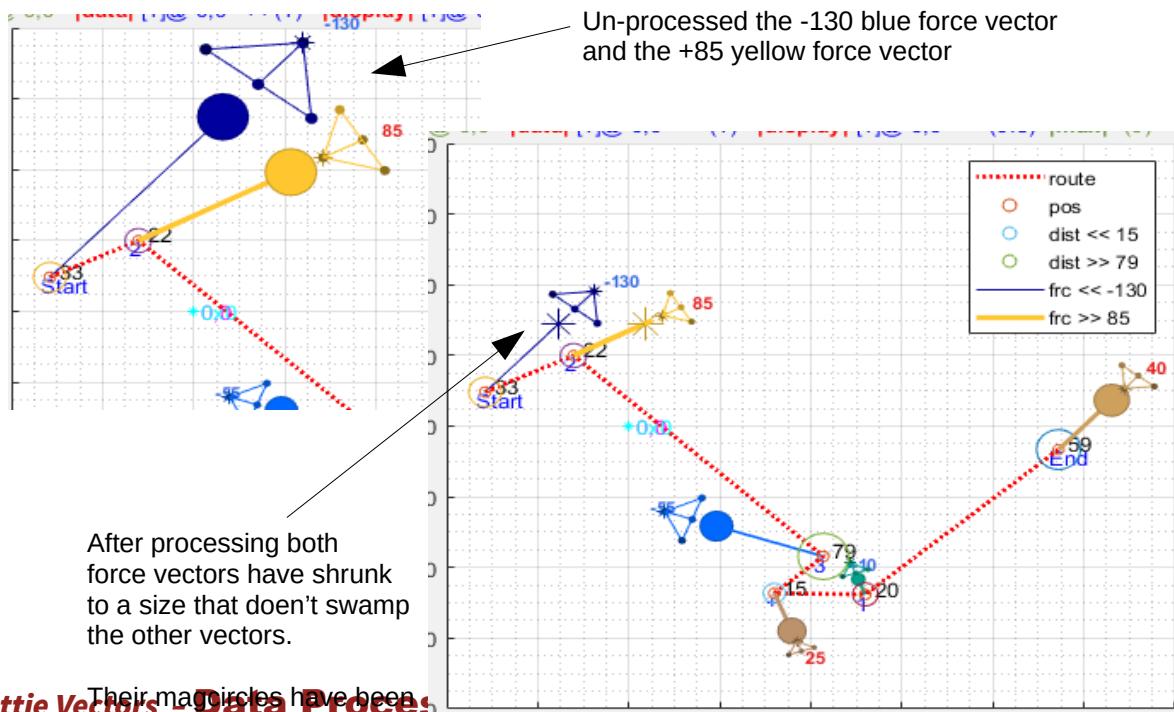
If you have a vector data where the majority of the force data is within a small range, but you have a few points where the magnitudes are much higher or lower. These kind forces can take up most of the display, making it harder to see trends in the rest of the data.

No fear ! Lottie Vectors has a handful of processing devices you can apply to your data directly from the window. Allowing you to smooth off the peaks and troughs and along with the other controls to explore and go deep !

Normalizing trims off spikes from the top and bottom of the dataset starting with the largest. The value is the actual number of spikes to cut. Even if the spike isn't really a spike, normalize will go on until the value is reached.

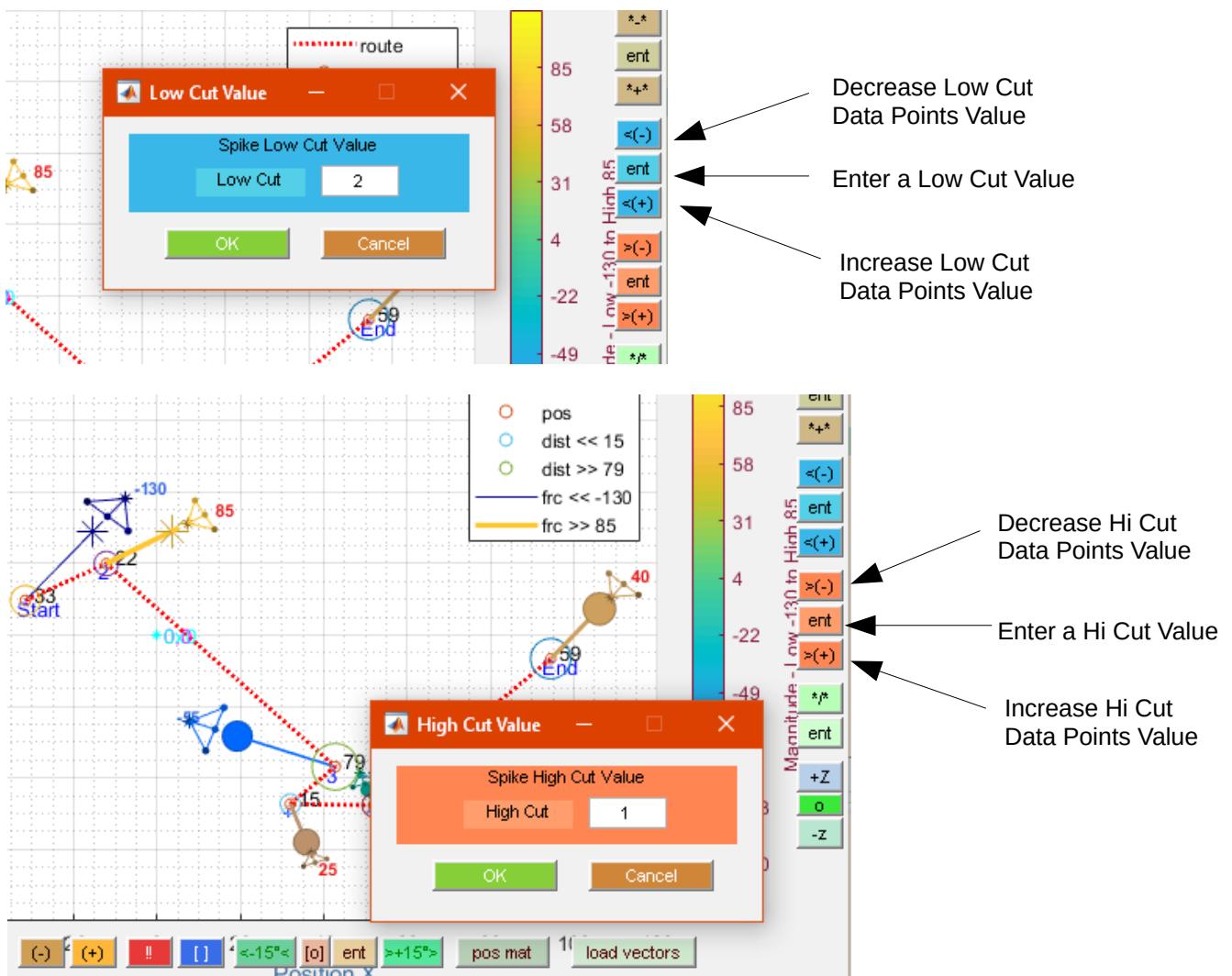


The results of methods of cutting is to remove the spike, keeping it's displayed magnitude, but giving it the length of the next greatest force vector.

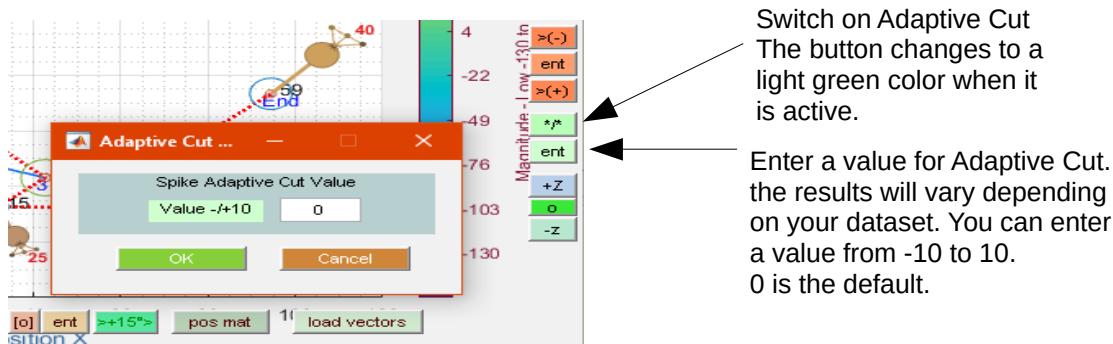


Lottie Vectors - Data Processing / Smoothing Spikes Continued

Hi and Low cutting removes data points ‘manually’ from the top end (Hi) or the low end (Low) of the dataset.



You can combine all of the methods together. The order of processing is Normalize, Low Cut, High Cut and then the final Adaptive Cut, which is a more automatic method shown next.



Adaptive tries to ‘guess’ where the spikes are in your dataset. It’s in it’s first version here, but it can still be useful and is included in this version.

Appendix 1 - Special characters datasheet

Lottie Vectors – Information document

(Release 1.16) Fall 2018

This document describes the code numbers which relate to the position references that appear on screen when appended to a vector dataset. It covers releases from 1.16 onwards. Please go to the website at lottiemath.github.io and follow the links there to Lottie Vectors if you have a newer software version.

By Charlotte Élisabeth Ameil

UoE, September 2018

twitter.com/mathlottie

When entering vector datasets the final column is for position reference markers. This is an integer number greater than 0 which is mapped to one of the symbols listed below. If a zero is specified the program skips the marker, and nothing is displayed.

Provision is made for the user to define their own references, these are reserved as negative codes, beginning with (-1). As of release 1.16, 99 such codes can be defined within the program and stored along with setup data as a preference file.

Such a file can be made portable and distributed to other uses with the vector file for display on their local machine. A symbol import function without affecting other local user preferences should be available.

Two special cases are also available. 1 displays the vector's number counted from the beginning, while 2 displays the vectors number counted from the first 2. If the dataset breaks a chain of 2's then this number is reset. The printed symbols below therefore start at 3.

3 = "start"	44 = cong	85 = "w"
4 = "end"	45 = 'approx' symbol	86 = "W"
5 = "x"	46 = Re	87 = "y"
6 = "X"	47 = 'oplus' symbol	88 = "Y"
7 = "o"	48 = cup	89 = "z"
8 = "O"	49 = 'subset equals' symbol	90 = "Z"
9 = "a"	50 = 'in' symbol	91 = f(x)
10 = "b"	51 = lceil	92 = g(x)
11 = "c"	52 = tau	93 = h(x)
12 = "A"	53 = cappa	94 = "!"
13 = "B"	54 = 'super set' symbol	95 = "#"
14 = "C"	55 = varsigma	96 = "@"
15 = "i"	56 = Im"	97 = "HIT"
16 = "j"	57 = otimes	98 = "miss"
17 = "k"	58 = nabla	99 = "Aquired"
18 = "I"	59 = wp	100 = "Lost"
19 = "J"	60 = aleph	101 = "Found"
20 = "K"	61 = neq	102 = "Detect"
21 = alpha (lower case)	62 = equiv	103 = "Fail"
22 = beta (lower case)	63 = divide	104 = "Out"
23 = gamma (lower case)	64 = propto	105 = "In"
24 = Alpha (upper case)	65 = varpi	106 = "Target"
25 = Beta (upper case)	66 = left arrow	107 = "Error"
26 = Gamma (upper case)	67 = left arrow bold	108 = "Success"
27 = delta (lower case)	68 = up arrow	109 = "Win"
28 = phi (lower case)	69 = right arrow	110 = "Down"
29 = omega (lower case)	70 = right arrow bold	111 = "In-Range"
30 = Delta (upper case)	71 = down arrow	112 = "Out-Range"
31 = Phi (upper case)	72 = infinity	113 = "Scan";
32 = Omega (upper case)	73 = left and right arrow	114 = "Wait"
33 = theta (lower case)	74 = partial	115 = "Paused"
34 = lambda (lower case)	75 = playing cards club	116 = "Continue"
35 = sigma (lower case)	76 = playing cards diamond	117 = "Stop"
36 = Theta (upper case)	77 = playing cards hearts	118 = "Go";
37 = Lamda (upper case)	78 = playing cards spade	119 = "Download"
38 = Sigma (upper case)	79 = circle	120 = "Upload"
39 = Upsilon	80 = pm	121 = "Tracking";
40 = Psi	81 = "u"	122 = "Dive"
41 = 'forall' symbol	82 = "U"	123 = "Flight"
42 = 'exists' symbol	83 = "v"	124 = "Take Off"
43 = ni	84 = "V"	125 = "Landing"

[Vector Reference Codes]

Appendix 2 - Special characters datasheet 2 (extended physics)

Lottie Vectors – Information document

(Release 2.0) Fall 2018

This document describes the code numbers which relate to the position references that appear on screen when appended to a vector dataset. It covers releases from 2.0 onwards. Please go to the website at lottiemath.github.io and follow the links there to Lottie Vectors if you have a newer software version.

By Charlotte Élisabeth Ameil

UoE, October 2018

twitter.com/mathlottie

[Vector Reference Codes]

Supplementary datacodes for Lottie Vectors 2.0 and onwards.

Negative numbers are reserved for user use and there will be an in-program option to define a ‘site set’ of codes in a future release.

When entering vector datasets the final column is for position reference markers. This is an integer number greater than 0 which is mapped to one of the symbols listed below. If a zero is specified the program skips the marker, and nothing is displayed.

Provision is made for the user to define their own references, these are reserved as negative codes, beginning with (-1). As of release 2.1x, 99 such codes can be defined within the program and stored along with setup data as a preference file. As of 2.0 users can type in any text while in either Edit or Add vector windows. However the labels will not be stored outside of a Listing file.

126 = "+"	142 = "G^uv"	158 = "W^uv"
127 = "{}"	143 = "Gf"	159 = "Wu ¹ "
128 = "<>"	144 = "gUV"	160 = "Wu ² "
129 = "()"	145 = "g1,g2"	161 = "Wu ⁺ "
130 = "Au"	146 = "J^u"	162 = "Wu ⁻ "
131 = "Auv"	147 = "j^u"	163 = "Zu"
132 = "AFB"	148 = "l ³ "	164 = "alph(Q ²)"
133 = "B^u"	149 = "Q ² "	165 = "alph.s(Q ²)"
134 = "B^uv"	150 = "q^u"	166 = "y^u"
135 = "b,b"	151 = "Tv^u"	167 = "u,uL,uR"
136 = "d,d"	152 = "uk"	168 = "veL,vuL,vtL"
137 = "dk"	153 = "uL,uR"	169 = "p(E)"
138 = "e,eL,eR"	154 = "u+,u-"	170 = "t,tL,tR"
139 = "F^uv"	155 = "vL,vR"	
140 = "Fabc"	156 = "v+,v-"	
141 = "G^u";	157 = "W^u"	

Appendix 3 – Demonstration Vector Datasets

Data Set 1 (the built-in vectors)

6, 33, 5.00909, 3, -130, 40, 1

6, 22, 2.35619, 3, 85, 60, 5

6, 79, 1.29154, 3, -55, 290, 5

6, 15, 1.57080, 3, 25, 160, 7

6, 20, 3.92699, 3, -10, 340, 8

6, 59, 5.49779, 3, 40, 40, 2

Data Set 2 (Right Angle Return Path)

6,33,5.0091,3,-130,40,1

6,22,2.3562,3,85,60,5

6,79,1.2915,3,-55,290,5

6,15,1.5708,3,25,160,7

6,20,3.927,3,-10,340,8

6,59,5.4978,3,40,40,2

8,50,0,8,10,5,0

8,50,180,8,10,15,0

8,50,270,8,10,5,0

Data Set 3 (Single Vector)

6,79,1.2915,3,-55,290,0

Data Set 4 (Route Only)

33, 288, 1

22, 63, 0

29, 134, 0

15, 228, 3

20, 90, 4

29, 43, 2

Appendix 4 – Version 2.x Command Line Interface Options

If you have more than one option you'll need to put 'everything in quotes like this'. For example

`lottievectors -help -bugs`, wont work but

`lottievectors '-help -bugs'` will..

`< path/filename >` Load vector data file. (.dat default extension if none)

`1 to 99` Load a preferences file with that number at start

`0` Load the built in defaults, skipping preferences

[display options] :

<code>-nodisplay</code>	Don't use the figure window, text only
<code>-nocontrols</code>	Start with no controls around the border
<code>-controls</code>	Start with all controls on the window
<code>-turbo</code>	Begin in turbo, fast display mode
<code>split</code>	Begin in split screen mode

[vectors options] :

<code>-noroute</code>	Don't display red dotted route line
<code>-noforce</code>	Don't display any forces
<code>-asnumbers</code>	Show vector's index numbers (for editing)
<code>-nonegz</code>	Don't go below zero in 3D, -100 is as 100
<code>-nofancyarrows</code>	Display slightly simpler arrows for forces

[data options] :

<code>-xposmap</code>	Position map is X Based
<code>-yposmap</code>	Position map is Y based
<code>-noposmap</code>	Don't display the Position map at startup
<code>-posmap</code>	Display the Position map when starting
<code>-list</code>	Display a list of vectors at the start
<code>-nolist</code>	Don't list vectors at the start

[program options] :

<code>-about</code>	General information about the software
---------------------	--

-version **Actual version of your program**

-bugs **Where to report bugs to**

Appendix 5 – Built-In Dataset Synopsis

Lottie Vectors – Information document

(Release 2.0) Fall 2018

[Dataset Synopsis]

This document contains an automated synopsis relating to the built-in dataset of my MatLab(r) program, Lottie Vectors. It can be used to help debug or test newer versions for valid results. The report can be verified against running a listing from a '0' (zero) start from the command window. Please go to the website at lottiemath.github.io and follow the links there for more information.

By Charlotte Élisabeth Ameil

UoE, Ocotober 2018

twitter.com/mathlottie

LottieVectors output on 17-Oct-2018 at 18:27. 6 vectors in list.

--Synopsis--

Force, Mag Nat MAX= 85.0000 (vector 2) MIN= -130.0000 (vector 1)

Force, Mag Abs MAX= 130.0000 (vector 1) MIN= 10.0000 (vector 5)

Force Total = 136.3333 : |Total| = 246.5399

Position, Dist MAX= 79.0000 (vector 3) MIN= 15.0000 (vector 4)

Position, Angle MAX= 315.0002 (vector 6) MIN= 73.9998 (vector 3)

Position Distance Route = 228.0000 : Direct (1 to 6) = 126.9993

Position Plane Dimensions = (-31.5581, -47.6193) to (94.3931, 19.9767)

Position Plane Area = 8513.7912 : From vectors (1, 5) to (6, 2)

Position Vectors [6](Rel Mag+Rad) = 6 : 100 %

Force Vectors [3](Yax Mag+Deg) = 6 : 100 %

=====

vnum	: Position (Type, Data, Data)	: Force (Type, Data, Data)	: Marker
------	-------------------------------	----------------------------	----------

=====

1	: Rel Mag+Rad (33, 5.0091)	: Yax Mag+Deg (-130, 40)	: start
2	. Rel Mag+Rad 22, 2.3562	. Yax Mag+Deg 85, 60	. (count)
3	: Rel Mag+Rad (79, 1.2915)	: Yax Mag+Deg (-55, 290)	: (count)
4	. Rel Mag+Rad 15, 1.5708	. Yax Mag+Deg 25, 160	. ni
5	: Rel Mag+Rad (20, 3.927)	: Yax Mag+Deg (-10, 340)	: (count B)
6	. Rel Mag+Rad 59, 5.4978	. Yax Mag+Deg 40, 40	. end

=====

Lottie Vectors Manual 2.0

Last revision October 24 2018