<u>FlowLab 1.2.10 User's manual for</u> 057:020 Fluid Mechanics and Transport Process

Fall 2005

Nobuaki Sakamoto nsakamot@engineering.uiowa.edu

Quick Reference of how to use FlowLab 1.2.10

- 1. Folder structure of FlowLab
 - Where should we save our work? \rightarrow pp.3
- 2. Save the figures and data with appropriate format
 - How to save XY-plots figures? \rightarrow pp.4
 - How to save contour/vector/streamline plots? \rightarrow pp.5~pp.6
 - How to save simulation data by HTML format? \rightarrow pp.7~pp.8
- 3. Importing and Exporting data
 - How to import EFD/AFD data to CFD simulation result? \rightarrow pp.8~pp.10
 - How to export CFD simulation results seen in XY-plots window? \rightarrow pp.9~pp.10

4. Make the nice figures

- Modify the appearance of XY-plots window \rightarrow pp.11~pp.12
- How to change the contour variables? \rightarrow pp.12~pp.14
- How to change the appearance of vector plot? \rightarrow pp.14~pp.16
- How to change the appearance of streamline plot? \rightarrow pp.16

5. Other graphical tips

- How to expand/scale-down/rotate/move the figure? \rightarrow pp.17
- How to make the figure as a default setting? \rightarrow pp.17

1. Folder structure of FlowLab

1.1 Working directory

Usually, working directory is named as 'myflowlab' in the PC you are using, and the work that is being executed is housed in '.scratch.(JOB-ID)' folder under 'myflowlab' as seen in Figure 1.1. It is strongly recommended that the '.scratch.(JOB-ID)' folder **should be deleted after your work is saved to your own directory that is made under myflowlab** (see 1.2 for more detail) since it wastes the capacity of the hard-disk a lot.



Figure 1.1 - Example of working directory

1.2 Saving your job with unique name

You must save your own work in this directory with unique name as seen in Figure 2. To save your work, 'File' \rightarrow 'Save as...' \rightarrow type in your own job-name \rightarrow 'Accept'. Then, go to 'myflowlab' and confirm if your own job is saved with unique.



Figure 1.2 - Example of saving directory

2. Save the figures and data with appropriate format

2.1 Save the XY-plots figures with printer-friendly format

In the XY-plots window (see the Figure 2.1.1 and Figure 2.1.2),

Hardcopy \rightarrow choose the export format (i.e. extension) of a figure \rightarrow check 'Printer Friendly Colors' box on \rightarrow Browse... \rightarrow go to your own save-dir (because default setting might be working directory) \rightarrow type the file name in 'File Name' box \rightarrow Ok \rightarrow Save



Figure 2.1.1 – Example of exporting XY-plots figure



Figure 2.1.2 – Example of Printer-friendly XY-plots figure

2.2 Save the contour/streamline/vector plot

In the main window (see Figure 2.2.1),

File \rightarrow Print Graphics \rightarrow in the 'Destination' section, choose 'File' \rightarrow choose the export format of the figure (Make sure that the 'File Name' box is **blank**!!) \rightarrow Browse... \rightarrow type in the correct path of your own save-dir in the 'Filter' box \rightarrow Filter \rightarrow type in the name of the figure that you want to save in the last line of the file-path seen in 'Selection' box \rightarrow Accept



Figure 2.2.1 – Procedure of exporting contour/streamline/vector figure

Save the report file by HTML format

In the main window (see Figure 2.3.1)

File \rightarrow Reports \rightarrow Create Report \rightarrow Browse... \rightarrow (Make sure that the 'File Name' box must be **blank**!!) \rightarrow type in the correct path of your own save-dir in 'Filter' box \rightarrow Filter \rightarrow type in the name of the report file that you want to save in the last line of the file path seen in 'Selection' box \rightarrow Accept \rightarrow Accept



X Select File		×
Filter		
G:\flowlab 1.2\F	Fluent.Inc\flowlab1.2\saving-directory*	
Directories		Files
lab1.2\saving=((lab1.2\saving=((lab1.2\saving=(lirectory\ lirectory\Pipeflow-06_29_2005_Nobuaki	nc\flowlab1.
Selection		
G:\flowlab 1.2\F	luent.Inc\flowlab1.2\saving-directory\pipe-fl	ow-report
Accept	Filter	Cancel

Figure 2.3.1 – Procedure of exporting report file by HTML format

- 3. Importing and exporting the data
 - 3.1 Importing the experimental data (i.e. EFD data) to CFD solution

Before importing the experimental/analytical data, those data must be derived by the **acceptable format so that FlowLab can read**. The format is seen in Figure 3.1.1. In Figure 3.1.1, you must type in the title of the data to be imported in section 1, type in the label of the data in section 2, and type in the label name that will be seen in XY-plots window in section 3. Make sure that the extension of the file to be imported must be **'.xy'** or **'.dat'**.

📕 Pipe-la	minar-AFD.xy	- Notepad		_ 🗆 🗵
<u>F</u> ile <u>E</u> dit	Format View	Help	_	
(title	"Velocity	Magnitude'	Section	1 🔺
(labels	"Position	n" "∕elocit	ty Magnit	ude")
((xy/ke	y/label ' <mark>a</mark>	analytical	') Sectio	on 2
0 0.005 0.01 0.015 0.02 0.021 0.022 0.023 0.024 0.025	0.4 0.3854209 0.3416838 0.2687888 0.1667353 0.1428258 0.1177493 0.0915074 0.0640988 0.0355239	Section 3 357 517 319 59 736 46 36 337		

Figure 3.1.1 – Sample format of the data to be imported

After you create the experimental/analytical data with acceptable format seen in Figure 3.1.1, in XY-plot window (see figure 3.1.2),

File \rightarrow check 'Import Data' box on \rightarrow Browse... \rightarrow go to the directory where the data to be imported exists, and choose the file \rightarrow Ok \rightarrow Import



3.2 Exporting CFD results

In XY-plots window (see Figure 3.2.1, Figure 3.2.2 and Figure 3.2.3),

File \rightarrow check 'Export Data' box on \rightarrow Browse... \rightarrow go to your own save-dir and type in the file name that you want to export, then press Ok \rightarrow Export \rightarrow confirm the message window as seen in Figure 3.2.2 \rightarrow go to your own save-dir and confirm that the data is exported with '.csv' format as seen in Figure 3.2.3.

*** '.csv' format='Comma Separated Values' format. It can be read by Excel.***



Figure 3.2.1 – Exporting the data

Information	
Data exported to G:\flowlab 1.2\Fluent.inc\flowlab	1.2\saving-directory\pressure-distribution.csv
	<u>OK</u>

Figure 3.2.2 – Message of exporting data succeeded



Figure 3.2.3 – Example of exported '.csv' file

4. Make the figures nice

4.1 Turn off the major and minor rules in XY-plots window

In XY-plots window (see Figure 4.1.1),

Axes \rightarrow in 'Option' section, turn the 'Major Rules' and 'Minor Rules' boxes off in both x and y axis \rightarrow DO NOT forget to press 'Apply' every time after you make a change in each axis.

201yaat		es		
Forstand 1.07 -001 1.07 -001 1.07 -001 1.07 -002 1.07 -002		Axis Color Label Iterations	Number Format Type General - Precision 3 +	Major Rules Color r Weight 1 ₹
1.6 00 1.6 00 1.6 00 1.6 00 1.6 00 1.6 00		Options Range Log Minimum Major Rules Maximum	0	Minor Rules Color Weight
1.6C.000 0 40 100 100 2 Berdbers	oo 240 210 329 340 400 Oydson ♥ About Out	Change Plot Title Ok	Apply	Cancel
Axes		Бууран		
Axes	Number Format Type General - C Precision 3 - W	Ajor Rules olor feight 1_2 1.6.001	234 4 2 1 1	یر ایک
Axes Axis C x C y Color Label Residuals Options Log Minimum Major Rules Minor Rules Change Plot Title	Number Format Mar Type General Precision 3 V	Lior Rules lor Rules lor Rules lor Lat 001 1.45 002 1.45 000		Le L

Figure 4.1.1 – Turn off the major and minor rules in XY-plots window

4.2 Don't want to show too many lines in one figure

In XY-plots window (see Figure 4.2.1),

Curves \rightarrow keep pressing 'Ctrl' key and select the lines you want to show (in Figure 4.2.1, the line of continuity and y-velocity residuals are supposed to be shown.) \rightarrow Apply \rightarrow Ok



Figure 4.2.1 – Selecting lines to be shown

4.3 To see the color contours/vectors/streamlines

In 'Postprocessing Objects' window (see Figure 4.3.1),

Choose one of three object that you want to see \rightarrow Active \rightarrow Modify (Make sure that the 'Attributes' box is checked.)

***You will see red lines in both vertical and horizontal direction, however, they will disappear after you close the 'Modify Simulation Object' window. ***



Figure 4.3.1 – Activate the postprocessing objects

<u>To change 'contour' variables</u>, in 'Modify Simulation Object' window (see Figure 4.3.2),

Edit \rightarrow in 'DOF' box, choose one contour variable that you want to show \rightarrow Apply



Figure 4.3.2 – Change contour variables

<u>To change the postprocessing object</u> (e.g. from contour plot to vector plot), in 'Postprocessing Objects' window,

'Deactive' contour first→then, choose vector→Active→Modify

In the 'Edit' mode of vector plot,

You can change the scale (i.e. length of the vector) by using 'Scale' variables as seen in Figure 4.3.3. Play around to find the appropriate size of vector to show. After specifying the scale, **DO NOT forget to click 'Apply' to update your figure.**

Specify Vector Attributes	
DOF: velocity vectors	
Color	
🔶 Magnitude	
🔶 DOF pressure 🗖	
Vector Magnitude:	
Minimum (2.691504 Restore	
Maximum (9.1490838 Restore	
Scale (0.003	
Arrowheads	
Components 📕 x 📕 y 📕 z	
◆ Time Step	
✓ Animate Between Time Steps	
Start Time Slop	
0.0000e+000 secs.	
6 8886a - 868 - acce	
Garagerere sets.	
Commons Loop	
Movie name Jalifor-Pro	
Apply Reset Close	Einer 4.2.2 Channel the seale of seat
	IFigure 4.5.5 – Change the scale of vect

Also, you can choose any components of vectors, for instance, if you want to plot only x-component of velocity vector, you must activate only x for 'Components' check box as seen in Figure 4.3.4. Again, **DO NOT forget to click 'Apply' to update your figure.**

Specify Vector Attributes
DOF: velocity vectors 🖃
Color
♦ Magnitude
Fixed
Vector Magnitude:
Minimum 2.691504 Restore
Maximum 19.1490838 Restore
Scale 10.003
Arrowhoods
Components
◆ Time Step
Animate Between Time Steps
Start Time Slep 1
0.0000e+000 secs.
End Thee Step 1
🔟 Continuous Loop
🔟 Generala Movie
Movie name jalifoil-Pro

Figure 4.3.4 – Choose any components of vector

Streamline plot is equivalent to stream-function plot in 'contour' mode as seen in Figure 4.3.4, therefore, use stream-function plot in 'contour' mode and **DO NOT use 'streamline' mode**.

	ontour Attributes
DOF: stream-	-function 🔟
Contour Type	
🔶 Lines	🔶 Wire-isosurfaces
🔷 Bands	🕹 Isosurfaces
🔷 Smooth	🔷 Cloud
Color Map:	
Intervals (10)	0
Minimum 10	Restore
Maximum [10;	2.128 Restore
-	
 Time Step 	1 = 1
◆ Time Step	
◆ Time Step	<u>ا ا</u> 0.0000e+000 secs.
◆ Time Step ↓ Animate Betw	1 0.0000e+000 secs. veen Time Steps
 Time Step Animate Betw Start Time Slep 	1 0.0000e+000 secs. //een Time Steps
 Time Step Animate Betw Start Time Step 	1 0.0000e+000 secs. //een Time Steps 0.0000e+000 secs.
 Time Step Animate Betw Start Time Slep 	1 0.0000e+000 secs. //
 Time Step Animate Betw Start Time Step End Time Step 	1
 Time Step Animate Betw Start Time Step End They Step 	1 0.0000e+000 secs. yeen Time Steps 0.0000e+000 secs. 1 0.0000e+000 secs.
Time Step Animate Betw Stert Time Slep End Time Step Continuous	1 0.0000e+000 secs. veen Time Steps 0.0000e+000 secs. 1 0.0000e+000 secs. Loop
Time Step Animate Betw Start Time Step End Time Step Continuous Generate M	1 0.0000e+000 secs. veen Time Steps 0.0000e+000 secs. 1 0.0000e+000 secs. Loop 109/e
Time Step Animate Betw Start Time Slep End Time Step Gontinuous Generate Movie name	1 0.0000e+000 secs. veen Time Steps 0.0000e+000 secs. 0.0000e+000 secs. 0.0000e+000 secs. Loop loyue Tableul-Free

Apply Reset Gose Figure 4.3.4 – Stream-function plot in 'contour' mode

To make the band of streamline narrow,

Edit \rightarrow change 'Minimum' and 'Maximum' values of streamline as seen in Figure 4.3.4. Play around to find suitable variables of 'Minimum' and 'Maximum'. The number of 'Intervals' is recommended as 100. Again, DO NOT forget to click 'Apply' to update your figure. Wide-band streamline and narrow-band streamline are seen in Figure 4.3.5.



Figure 4.3.5 - Wide-band streamline and narrow-band streamline

5. Other graphical tips

To expand a part of a figure, there are two ways such as:

- 1. 'Ctrl' key + left button of mouse \rightarrow keep pushing 'Ctrl' button and make a rectangular box to where you want to expand \rightarrow let go the left button of the mouse
- 2. Keep pushing the right button of mouse, and move the mouse back and forth

To rotate the figure,

-Keep pushing right button of mouse, and move the mouse left and right

To move the object,

-Keep pushing center button of mouse, and move the mouse to the arbitrary direction

To recover the figure to the primary position and size,

-Use re-size and re-locate buttons as seen in Figure 5.1.1.



Figure 5.1.1 – Re-size and re-locate the figure