
Violin Arch Designer, v.1.0.0

User Manual

Hwang, Il-Seok*

* Violin Maker, H.I.S. Violin Atelier / www.hisviolins.com / hisviolins@gmail.com



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This software is a program that helps you create arches similar in shape to Stradivari's arches for making string instruments. By entering the instrument's size, six arches are created for each of the Front and the Back. The created arches are saved as PDF and DXF files. You can print them to make arching templates.

The six arches are automatically shaped like Stradivari's arches, and their Fullness can be adjusted through the options. (In this software, 'Fullness' is the term used to describe the degree of swelling of the arch on a 2D plane.)

As additional features, it includes a function to help change the shape of arch No. 6, a function to create a single arch separately, and a function to analyze the Fullness of all created arches.

This software uses a standard model based on arch data generated by making slight corrections to the violin, viola, and cello data from Simone F. Sacconi's book, 『The Secrets of Stradivari』 (pages 63~83). Therefore, this standard model cannot be considered the average or standard of Stradivari's arches. The arches created in the [Strad.] and [Strad.+User] modes follow the Fullness of this standard model. To change the Fullness of the arches, please select the [User] mode.

This software uses trochoids as the curves for creating arches. This is based on my research findings (Hwang Il Seok, The Reconstruction of the Stradivari Arch, <https://www.hisviolins.com/post/report-the-reconstruction-of-the-stradivari-arch>) that Stradivari's arches are very similar to Curtate Hypotrochoid and Curtate Epitrochoid curves. For the detailed principles of arch creation, please refer to the research report above.

All numbers displayed in this software use [mm] units.

1 Installation

This software is a portable version, so no separate installation process is required. Unzip the file and double-click the 《Violin_Arch_Designer_v.X.X.X.exe》 file in the 《Violin_Arch_Designer_v.X.X.X》 folder to run the program. However, depending on your computer's specifications, it may take some time to launch.

Please note the following points during installation and program execution.

■ Run as administrator

If the 《Violin_Arch_Designer_v.X.X.X》 folder is located in a Windows system folder, such as "Program Files" on the C drive, you must run the program as an administrator. Otherwise, the program may not work correctly, or files such as PDF, DXF, and TXT may not be saved properly.

■ Windows Security Settings

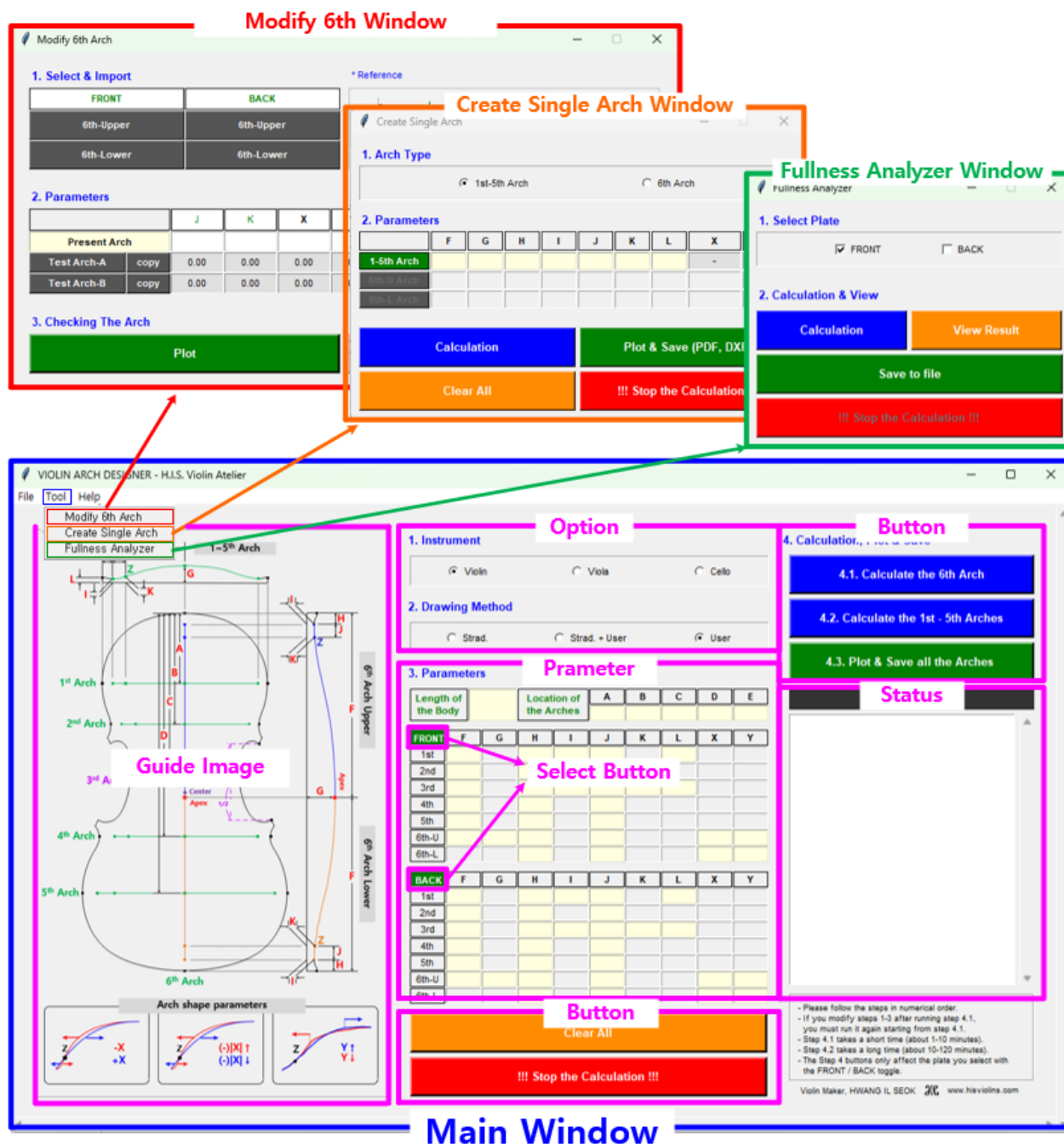
When you unzip the program file, Windows Security may automatically delete some files, considering them suspicious. In that case, you must restore the file from quarantine in the Windows Security settings and then unzip the file again. This software does not contain any viruses.

2 File Contents

The downloaded 《Violin_Arch_Designer_v.X.X.X.zip》 file contains the following files.

- size.png, logo.png, adjust6.png: Image files used by the program.
- complete.wav, warning.wav: Sound files used by the program.
- Violin_Arch_Designer_v.1.0.0.exe: The program's executable file.
- Standard_Violin, Standard_Viola, Standard_Cello: Folders containing the instrument data used as standard models in the program (for reference).

3 Screen Layout



The main window consists of a guide image, an option selection area, parameter input fields, various buttons, and a console output. From the Tool menu in the main window, you can access the Modify 6th Arch, Create Single Arch, and Fullness Analyzer windows.

- **Main:** Used to create the six arches for the Front and the Back (Main function).
- **Modify 6th Arch:** Used when you want to change the shape of the created 6th arch (Additional function).
- **Create Single Arch:** Used to create a single arch separately (Additional function).
- **Fullness Analyzer:** Used to calculate the Fullness of all created arches (Additional function).

4 How to Use

4.1 Main Window

※ You must follow the steps in the numerical order displayed on the screen.

■ Overall Procedure:

1. In **《1. Instrument》**, select the instrument.
2. In **《2. Draw Method》**, select the method (mode) for creating the arches.
3. In **《3. Parameters》**, select the plate to create (Front/xurl Back) and enter the instrument's size values.
4. In **《4. Claculation, Plot & Save》**, click the **[4.1. Calculate the 6th Arch]** button to calculate the 6th arch. When the calculation is complete, the 6th arch is displayed on the screen.
5. Click the **[4.2. Calculate the 1st-5th Arches]** button to calculate the remaining arches. When the calculation is complete, a completion message will be displayed.
6. Click the **[4.3. Plot & Save All the Arches]** button to save all the created arches to a file.

■ 1. Instrument

Select the instrument you want to create. Please be aware that if you change the instrument, all values entered in **《3. Parameters》** will be deleted.

■ 2. Drawing Method

Select the method for creating the arches.

- **[Strad.]**: Creates arches according to the standard model used in this software. You can only specify the total length of the instrument body (Length of the Body), the positions of the five arches (A,B,C,D,E), the plate width at the arch locations (F), and the thickness at the thickest part of the plate (G).
- **[Strad.+User]**: In addition to the **[Strad.]** method, you can also specify the position of the 6th arch's apex (F), the edge width (H), the thickness of the channeling area (I), and the edge thickness (L).
- **[User]**: You can specify all parameters manually.

※ In **[Strad.]** mode, you only determine the basic parameters, and most are based on the standard model. In **[User]** mode, you determine everything. **[Strad.+User]** is an intermediate step.

※ In the **[Strad.]** method, the edge width (from the plate's edge to the lowest point of the arch) varies depending on the location. If you want to make only C-bout narrower while keeping the others the same, select **[Strad.+User]** or **[User]** and enter the H value directly.

※ To change the arch's Fullness, select **[User]** and change the J or K values. The smaller the J value, the greater the Fullness. The larger the K value, the greater the Fullness.

✳ To change the shape of the 6th arch, select **[User]** and change the X or Y values. For changes in the arch shape according to the X and Y values, please refer to the guide image on the left of the main window and Chapter 4.2.

✳ When using **[Strad.+User]** or **[User]**, it may be difficult to determine the values for some cells. In such cases, first select **[Strad.]** mode. Then, click the **[4.1. Calculate the 6th Arch]** button. This will calculate and fill in all the other cells. It is recommended to use these values as a guide to determine the values you need. Once you have decided on the values, switch the mode back to **[Strad.+User]** or **[User]** and enter the decided values into the corresponding cells.

■ 3. Parameters

Enter the data required for creating the arches. The cells available for input change depending on the mode selected in **(2. Draw Method)**. Cells that require input are highlighted in yellow. The remaining cells will be automatically calculated and filled when you click the **[4.1. Calculate the 6th Arch]** button.

✳ If you want to create arches for only the Front or only the Back, you can turn them on or off by clicking the green **[FRONT]** / **[BACK]** toggle buttons in the table. (Green: ON, Gray: OFF)



✳ **[Clear All]** button: Clears all entered values at once.



■ 4. Calculation, Plot & Save

This section runs the calculations to create the arches. When the calculations are complete, it displays the created arches on the screen and saves them to files.

- **[4.1. Calculate the 6th Arch]**: Calculates the 6th arch. When the calculation is finished, it automatically displays the arch on the screen.

✳ The calculation takes about **1-10 minutes**. Larger instruments will take longer.

- **[4.2. Calculate the 1st - 5th Arches]:** Calculates arches 1-5. When the calculation is complete, only a message is displayed.
 - ※ Note: This calculation can only be performed after **[4.1....]** has been executed. The heights of arches 1-5 are determined by the 6th arch. Therefore, the 6th arch must be calculated first before arches 1-5 can be calculated.
 - ※ The calculation takes about **10-120 minutes**. Larger instruments will take longer.
 - ※ To stop the calculation while it is in progress, click the **[[!! Stop the Calculation !!]]** button at the bottom.
- **[4.3. Plot & Save all the Arches]:** Displays all the arches calculated above on the screen and saves them to files.
- **Current Status:** Displays the current progress and various information. During the calculation, details of the process are displayed continuously. (You can ignore these details, as they are intended for debugging potential program errors.) When the calculation is complete, information about the created arches will be displayed.

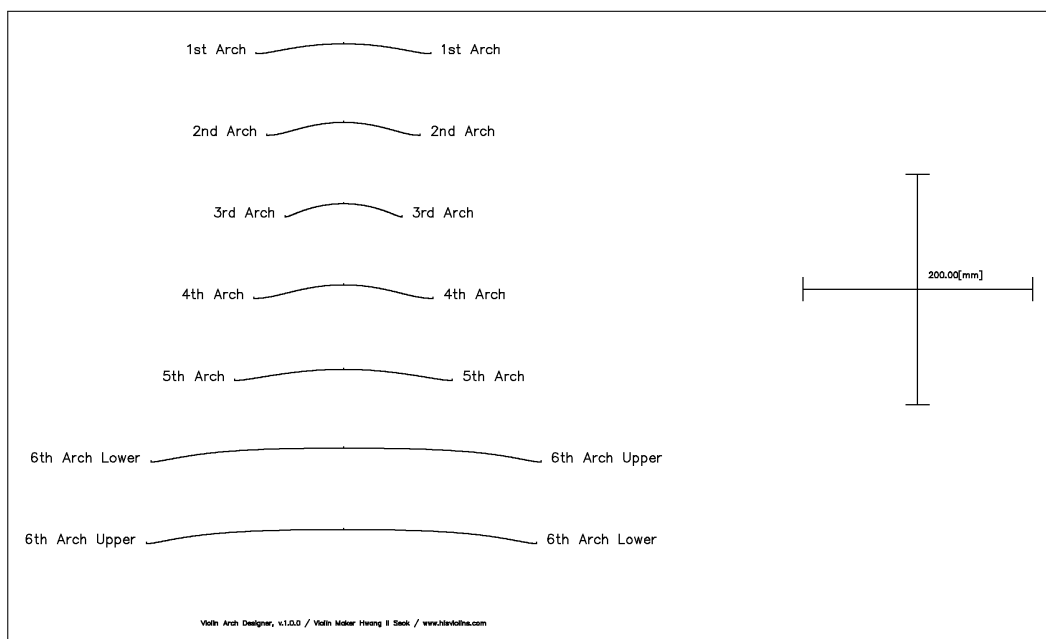
※ When plotting, a Contour Map for contour analysis is also displayed and saved along with the arch images. Please refer to the research report for more information about the Contour Map.

※ All images displayed on the screen are automatically saved as PDF files. Additionally, DXF files for printing are saved separately, although they are not displayed on the screen. DXF is a universal CAD file format that can be opened with most CAD software. (There are many free CAD software options available that can view and print these files. You can download and use one that suits your needs.)

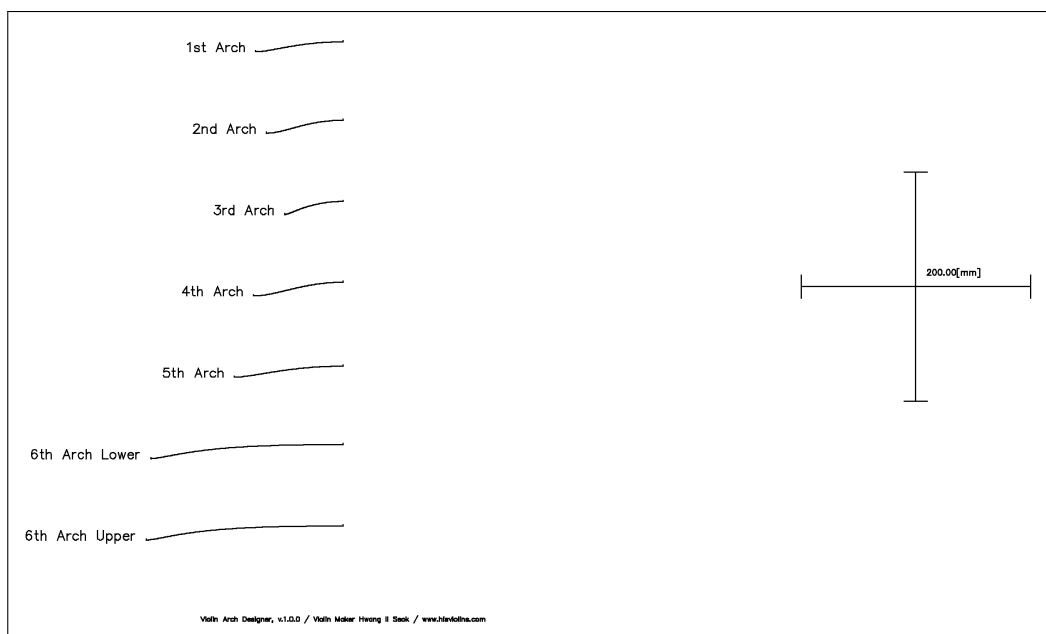
※ The files are automatically created in the same folder where the software's executable file (Violin_....exe) is located. If only the Front or the Back is selected, the Contour_Map_Comparison...pdf file will not be created.

logo.png	2KB	2022-01-24
complete.wav	349KB	2025-08-24
warning.wav	220KB	2025-08-24
adjust6.png	26KB	2025-10-31
size.png	66KB	2025-11-12
BACK_All_Arches_2025-11-15_17-02-04.pdf	34KB	2025-11-15
FRONT_All_Arches_2025-11-15_17-02-04.pdf	33KB	2025-11-15
BACK_All_Arches_Plate_2025-11-15_17-02-05.pdf	49KB	2025-11-15
FRONT_All_Arches_Plate_2025-11-15_17-02-04.pdf	49KB	2025-11-15
FRONT_Contour_Map_2025-11-15_17-02-05.pdf	36KB	2025-11-15
BACK_Contour_Map_2025-11-15_17-02-06.pdf	36KB	2025-11-15
Contour_Map_Comparison_A_2025-11-15_17-02...	38KB	2025-11-15
Contour_Map_Comparison_B_2025-11-15_17-02...	37KB	2025-11-15
FRONT_All_Arches_2025-11-15_17-02-06.dxf	363KB	2025-11-15
BACK_All_Arches_2025-11-15_17-02-07.dxf	363KB	2025-11-15
Violin_Arch_Designer_v.1.0.0.exe	106,428KB	2025-11-16

※ The DXF file includes guide crosshairs for accurate printing. Please print the crosshairs first and check if their size is correct before printing the arches. If the crosshairs are not the correct size, you will need to adjust your printer's scaling settings. (Most home printers have some margin of error.)



※ The DXF file has 'Left' and 'Right' layers. If you are making a half-template of the arch, please turn off either the 'Left' or 'Right' layer before printing.



4.2 Modify 6th Arch (window)

You can access this window by clicking **[Modify 6th Arch]** in the Tool menu of the main window.

✳ This function is used when you want to change the shape of the 6th arch. It can only be used after the calculation of the 6th arch (the **[4.1.]** button in the main window) is complete.

■ Overall Procedure:

✳ After completing the calculation in Main window **[4.1. Calculate the 6th Arch]**.

1. ① In **⟨1. Select & Import⟩**, select the arch you want to modify.
- ② When you select an arch, its data is imported. The data is then displayed in the **[Present Arch]** section of the table below. The values displayed in the **[Present Arch]** section are the calculated results for the currently selected arch. These values cannot be modified here.

1. Select & Import

FRONT		BACK	
6th-Upper	6th-Upper	6th-Upper	6th-Upper
6th-Lower	6th-Lower	6th-Lower	6th-Lower

2. Parameters

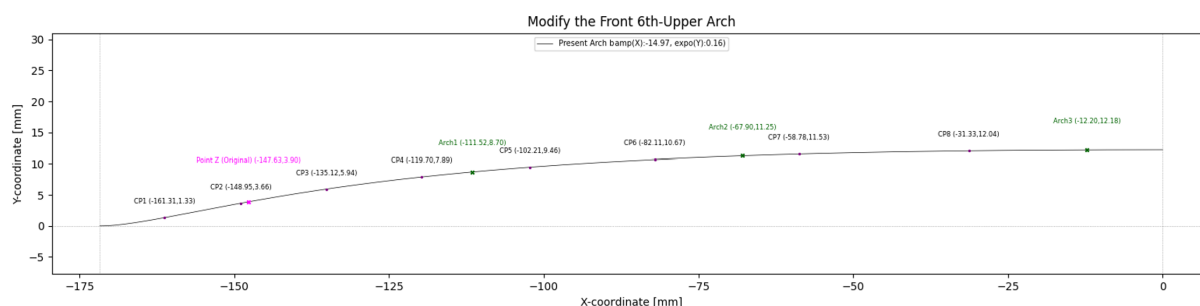
		J	K	X	Y	SCP-b (x)	SCP-b (y)	SCP-t (x)	SCP-t (y)	Best X,Y
Present Arch		24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339	
Test Arch-A	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.
Test Arch-B	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.

3. Checking The Arch

Plot

!!! Stop the Calculation !!!

2. ③ If you click the **[Plot]** button at the bottom in this state, the currently selected arch and its related points will be displayed on the screen. You can use the positions of these points as a guide to decide how to change the arch's shape.



3. To modify the arch shape, you do not directly edit the currently selected arch (the original arch). Instead, you find the optimal modified values by editing a copy. In other words, you create a copy of the **[Present Arch]**, called **Test Arch-A** or **B**, and then modify its values.

- ① Click the **[Test Arch-A]** or **[Test Arch-B]** button to activate the copy, and
- ② Press the **[copy]** button on the right to copy the original data. The copied data will be displayed on the right.

Arch	24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339	
Test Arch-A	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.
Test Arch-B	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.

Present Arch	24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339	
Test Arch-A	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.
Test Arch-B	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.

Present Arch	24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339	
Test Arch-A	copy	24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339
Test Arch-B	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.

4. ① Appropriately change the J, K, and SCP values of the copy,
 ② and press the **[Calc.]** button on the right to perform the calculation.

※ J and K represent the position of the Fullness Control Point Z, which is the reference point for determining the arch's Fullness. J is the distance from the end of the arch to point Z, and K is the distance from the bottom of the plate to point Z. The SCP (Shape Control Point) is the reference point for controlling the shape of the 6th arch. It consists of a bottom shape control point (SCP-b) and a top shape control point (SCP-t). These are expressed as absolute coordinates relative to the origin (0,0).

- ③ When the calculation is complete, the X and Y values are automatically updated.

※ **X and Y** are the parameters that determine the shape of the arch. The results of the above calculation are displayed here.

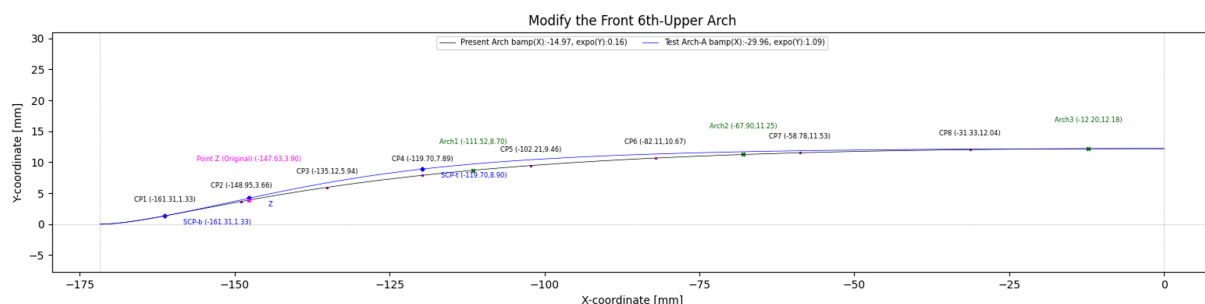
2. Parameters

	J	K	X	Y	SCP-b (x)	SCP-b (y)	SCP-t (x)	SCP-t (y)	Best X,Y
Present Arch	24.0734251	7.20045	-14.975	0.1625	-161.30573	1.33357867	-119.69972	7.88962339	Best X,Y
Test Arch-A	copy	24.0734251	7.5	-14.975	-161.30573	1.33357867	-119.69972	8.9	Calc.
Test Arch-B	copy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Calc.

3. Checking The Arch

Plot **!!! Stop the Calculation !!!**

5. ④ After the X and Y values are updated, click the **[Plot]** button at the bottom to compare the original arch with the modified arch. If both **[Test Arch-A]** and **[Test Arch-B]** are selected, both arches will be displayed.



6. If you want to view only the modified arch without displaying the original, you can deactivate the original arch by clicking the **[Present Arch]** button.

Present Arch **Present Arch**

7. Repeat the above process to determine the optimal arch you desire.
- ① Once the arch is decided, copy its X and Y values to a notepad or similar application, and close the Modify 6th Arch window.
 - ② Switch to User mode in the main window,
 - ③ enter the copied values into the X and Y fields in the main window,
 - ④ and recalculate the 6th arch.

■ X,Y Parameters

✳ You can also modify the X and Y values directly, without going through the process of calculating them by modifying the SCP values.

1. Instrument

Violin Viola Cello

2. Drawing Method

Strad. Strad. + User User

3. Parameters

Length of the Body	354.00	Location of the Arches	A	B	C	D	E
67.38	111.00	166.70	220.56	274.23			

4. Calculation, Plot & Save

4.1. Calculate the 6th Arch

4.2. Calculate the 1st - 5th Arches

4.3. Plot & Save all the Arches

Current Status

```

>>> Completed
>>> Final parameters :
>>> The Best X : -29.9625
>>> The Best Y : 1.0875
>>> Error at CP1 : -0.0010
>>> Error at CP4 : 0.0001
<<< Done.
    
```

※ The SCP values are used to determine the X and Y values. The final parameters used to create the 6th arch are J, K, X, and Y. J and K are used to determine the overall Fullness of the arch, while X and Y are used to determine its shape.

※ The shape of the arch changes according to the following rules.

- If the sign of X is negative (−): The slope of the lower part of the arch becomes steeper.
- If the sign of X is positive (+): The slope of the lower part of the arch becomes gentler.
- If the sign of X is negative (−) and its absolute value ($|X|$) increases: The slope of the lower part of the arch becomes steeper.
- If the sign of X is positive (+) and its absolute value ($|X|$) increases: The slope of the lower part of the arch becomes gentler.
- If the value of Y decreases: The slope of the lower part of the arch becomes steeper.
- If the value of Y increases: The slope of the lower part of the arch becomes gentler.

※ If inappropriate values are entered for X and Y, a warning message will be displayed. This means that the created arch is not normal.



4.3 Create Single Arch (window)

You can access this window by clicking **[Create Single Arch]** in the Tool menu of the main window.

※ This function is used when you want to create a single arch separately. It operates independently and is not related to the main window's functions.

■ Overall Procedure:

1. In **⟨1. Arch Type⟩**, select the type of arch you want to create. The input fields below will change dynamically depending on the selected arch type. (The creation principles for arches 1-5 and the 6th arch are different.)

2. Enter the parameter values in the input fields.

※ The 6th arch is divided into an upper arch and a lower arch. You can select either one or both. You can turn them on or off by clicking the **[6th-U Arch]** / **[6th-L Arch]** toggle buttons.

3. Enter the desired values in the input fields and calculate. ([Calculation])
4. After the calculation is complete, you can display and save the arch. ([Plot & Save (PDF,DXF)])

※ The files are automatically saved in the folder where the software's executable file is located.

4.4 Fullness Analyzer (window)

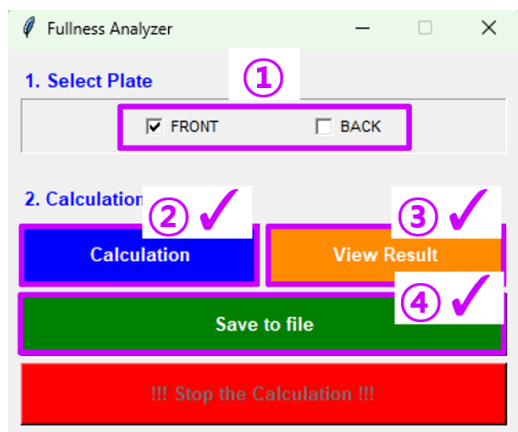
You can access this window by clicking **[Fullness Analyzer]** in the Tool menu of the main window.

※ This function is used when you want to analyze (calculate) the Fullness of the arches created in the main window. Therefore, it can only be used after all arch calculations are completed using the **[4.2....]** button in the main window.

※ This calculation takes a very long time. It takes about 3-5 times longer than the [4.2....] calculation in the main window, (if calculating both the Front and the Back, Violin: approx. 4 hours, Cello: approx. 12 hours). Please use this function only when absolutely necessary. Before starting the calculation, please configure your computer's settings to prevent it from automatically shutting down or entering sleep mode.

Overall Procedure:

- In **1. Select Plate**, select the plate you want to calculate.
(You can select one or both. By default, only the Front is selected.)



- Press the **[Calculation]** button to start the calculation.
- When the calculation is complete, press the **[View Result]** button to check the results.
✳ The results are displayed in a table. For an explanation of each value, please refer to the research report.

AFI and RFI											
Plate	No.	Area [mm ²]				AFI [%]				RFI [%]	Tolerance
		maxCHTA	CTDA	minCETA	ARCH	maxCHTA	CTDA	minCETA	ARCH	ARCH	
FRONT	1st	441.36	360.83	319.88	396.00	66.71	54.49	48.20	59.86	43.67	0.02
	2nd	504.65	425.54	373.57	425.95	67.25	56.61	49.62	56.67	0.52	0.02
	3rd	394.38	343.59	304.89	374.44	67.66	58.86	52.14	64.09	60.73	0.02
	4th	623.37	519.86	461.11	516.57	67.10	55.96	49.61	55.56	-5.59	0.02
	5th	566.81	497.38	439.55	552.34	61.67	54.01	47.70	60.01	79.15	0.02
	6th-U	1236.44	1105.87	971.95	1531.69	59.10	52.79	46.40	73.11	326.12	0.02
BACK	6th-L	1210.75	1081.91	998.59	1485.53	59.23	52.85	48.82	72.57	313.27	0.02
	1st	312.01	276.43	245.76	302.89	60.55	53.51	47.67	58.72	74.38	0.02
	2nd	444.56	370.09	334.20	371.31	67.22	55.87	50.40	56.05	1.63	0.02
	3rd	369.40	318.60	282.16	339.80	67.73	58.31	51.56	62.15	41.73	0.02
	4th	558.16	460.44	407.03	441.55	67.10	55.36	48.89	53.07	-35.37	0.02
	5th	423.21	377.30	337.53	440.40	59.71	53.11	47.56	62.05	137.45	0.02
	6th-U	1148.92	1028.98	960.22	1316.17	58.89	52.66	49.18	67.35	239.45	0.02
	6th-L	1121.63	1004.28	952.57	1242.62	58.98	52.72	49.93	65.24	203.10	0.02

- If you want to save the results, press the **[Save to File]** button. The results are saved as a comma-separated txt file.
✳ The file is saved in the folder where the software's executable file is located.

5 Development and Operating Environment

This software was developed in a 《Python 3.9 + Tkinter》 environment and has only been tested to work on 《Windows 11》.

6 Donation

This software was developed for all string instrument makers.

Anyone can use all its features for free, without any restrictions.

If this software has added value to your creations,

please support the next steps of H.I.S. Violin Atelier.

Your valuable support makes more in-depth research possible,

and will become a precious foundation for the advancement of string instrument making technology.

Thank you.

Support & Donation:

(Korea Only) KakaoBank / 3333-26-9281963 / HISVIOLIN

(International) PayPal: <https://paypal.me/37510519>

Bibliography

[1] S. F. Sacconi, *I 'segreti' di Stradivari*. Cremona: Libreria del Convegno, 1972, pp. 63–83.

Web site

H.I.S. Violin Atelier – <https://www.hisviolins.com>

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