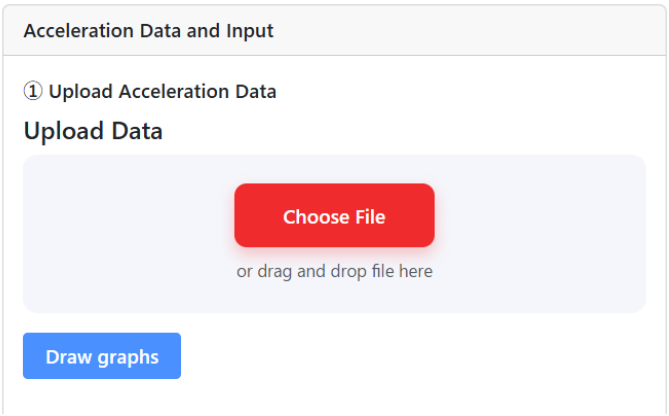
How to Use System Identification Web Application

This web application is designed to perform system identification of civil engineering structures using acceleration time-series data. The application estimates structural dynamic properties such as natural frequency, damping ratio, and mode shape based on synchronized acceleration measurements from multiple sensors.

The application currently supports SSI-based analysis and mode-shape visualization using user-defined sensor and support locations.

Uploading Acceleration Data

Drag and drop the acceleration data file into the upload area or select the file manually using the “Choose File” button. After selecting the file, click “Draw graphs” button to load the data into the web application.



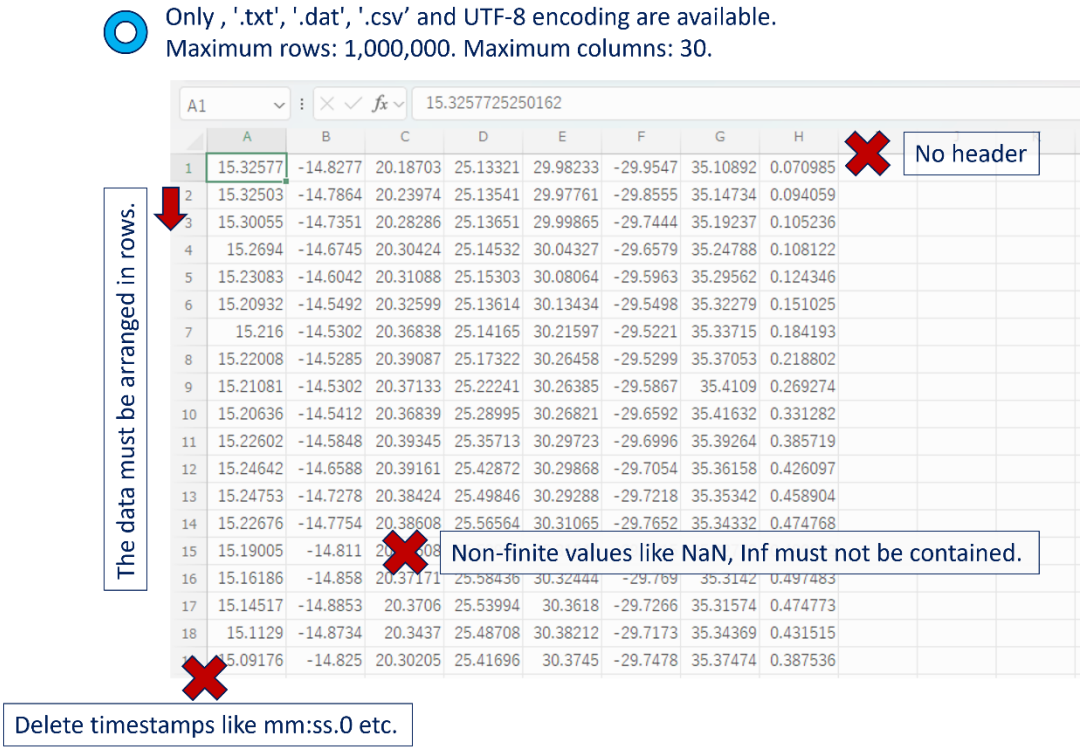
Points to note regarding uploaded data

Please prepare the uploaded acceleration data according to the following rules:

- The data should be acceleration time-series data.
- The data should not contain a header row.
- The data should not contain timestamp columns.
- Each column should correspond to one accelerometer/sensor.
- The number of columns in the acceleration data must match the number of sensors

registered in the sensor location setting.

- The data should not contain NaN, Inf, blank cells, or non-numeric values.
- UTF-8 encoded CSV data is recommended.
- The acceleration data should be synchronized if multiple sensors are used.



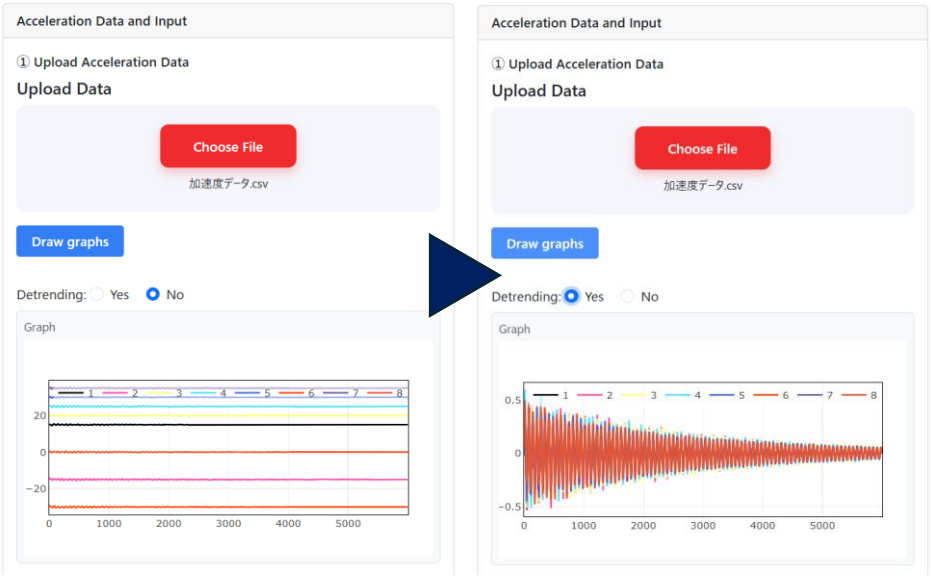
Checking the Waveform and Selecting Detrending

After uploading the acceleration data, the waveform will be displayed in the graph area.

Use this graph to confirm that:

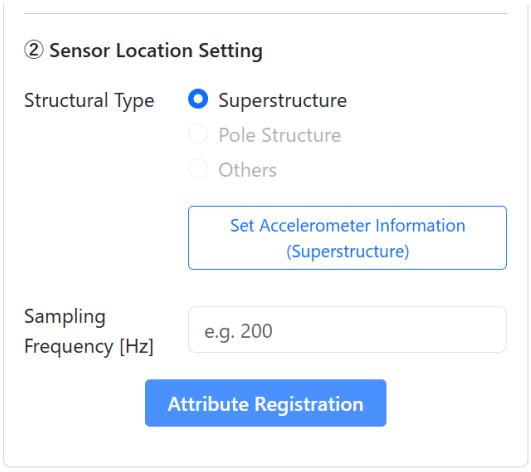
- The acceleration data has been uploaded correctly.
- The number of plotted signals matches the number of sensors.
- The waveform does not contain abnormal spikes, missing data, or unexpected offsets.
- The signal is reasonably centered around zero.

If the acceleration signal contains drift or a non-zero mean value, select Detrending: Yes as detrending removes long-term trends and DC components from the acceleration data before SSI analysis.



Selecting Structural Type

Select structural type from the available options: superstructure, pole structure and others. Currently, only the superstructure option is available. Pole structures and other structural types will be supported in a future version.



Setting Sensor and Support Locations

After selecting the structural type, press the “Set Accelerometer Information” button to define the sensor and support locations. These settings are used to create the mode-shape plot after the SSI calculation.

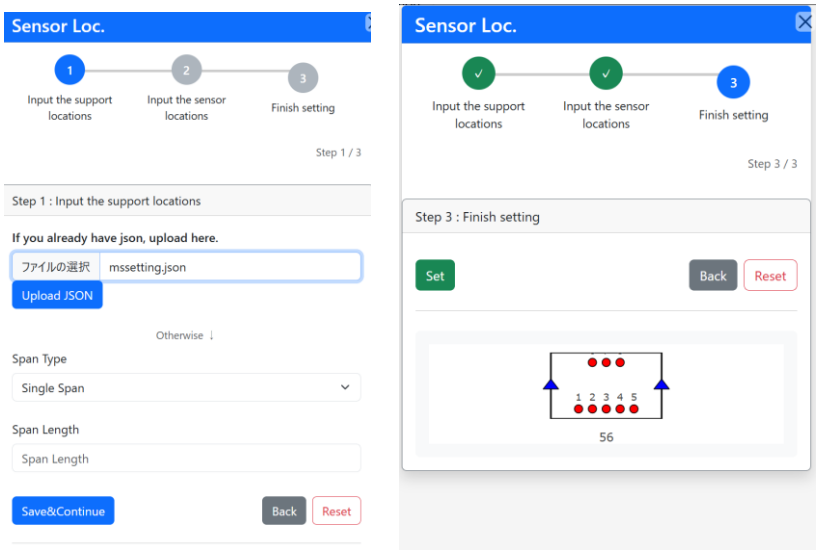
The sensor location setting page requires input for the following information:

- Span type: Single, Double and Triple
- Span length
- Sensor locations

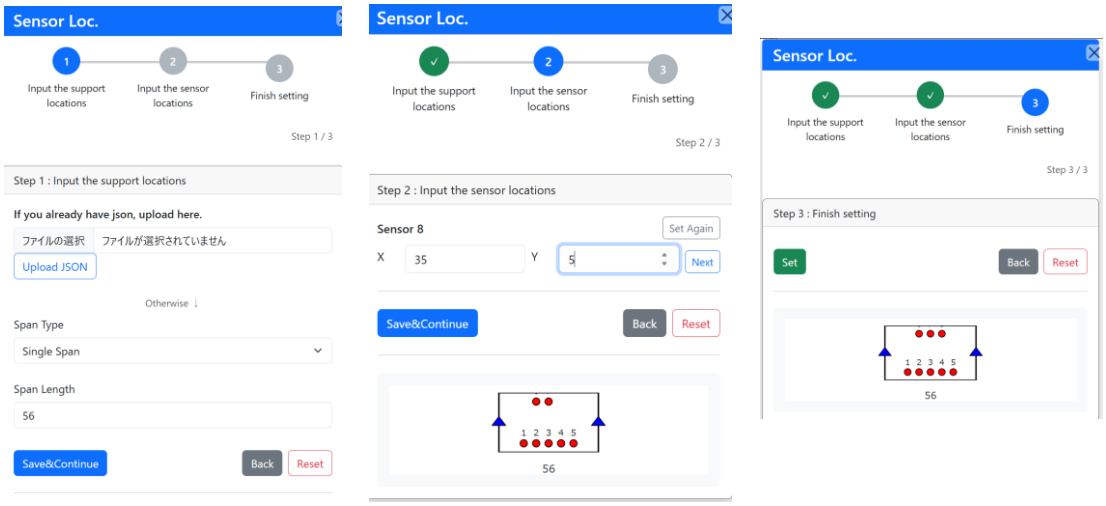
Support locations are assumed based on the span type and each span length.

There are two ways to input the information.

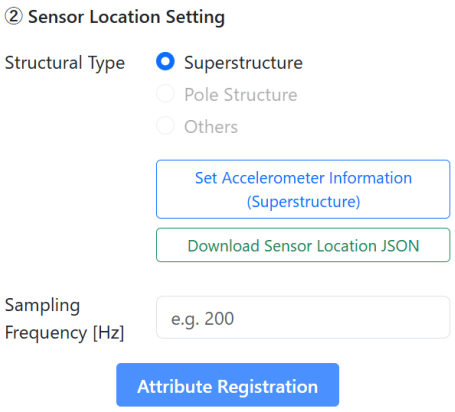
1. Uploading JSON file: If you already have a sensor-location JSON file of sensor location, press “ファイルの選択” to select json file. After selecting the file, press “Upload JSON” to proceed. The sensor location setting page will go to step 3 which is the finish setting page. Please check if the sensor and support locations are accurate. Press “Back” to modify information if needed. If not, press “Set” to proceed.



2. Inputting information manually: Select the span type, then enter the required span lengths. Press “Save&Continue” to proceed. “Step 2: Input the sensor locations” will appear. Input the X coordinate and Y coordinate of each sensor in the same order as the acceleration data uploaded above. Press “Next” to input the next sensor locations. Once all sensor locations are input, press “Next” then “Save&Continue”. The sensor location setting page will go to step 3 which is the finish setting page. Please check if the sensor and support locations are accurate. Press “Back” to modify information if needed. If not, press “Set” to proceed.



After setting the sensor location, the “Download Sensor Location JSON” button will appear. The sensor location can be downloaded and uploaded easily in the future analyses, instead of inputting sensor location manually.



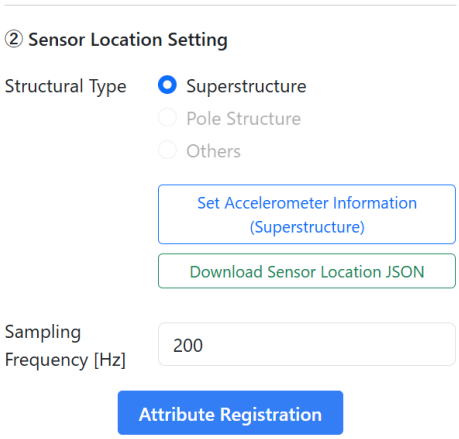
Important Notes

The number of sensors registered in the sensor location setting must be the same as the number of columns in the uploaded acceleration data. For example, if the acceleration CSV has 3 columns, the sensor location setting must contain 3 sensors. If the numbers do not match, the application will show an error, and the SSI analysis cannot proceed.

Registering Data Attributes

Enter the sampling frequency of the acceleration data in Hz, then click the “Attribute Registration”

button. If the registration succeeds, the application will store the selected attributes and use them during SSI analysis.



Selecting Identification Method

Select the identification method: SSI or FDD. FDD is currently under development.

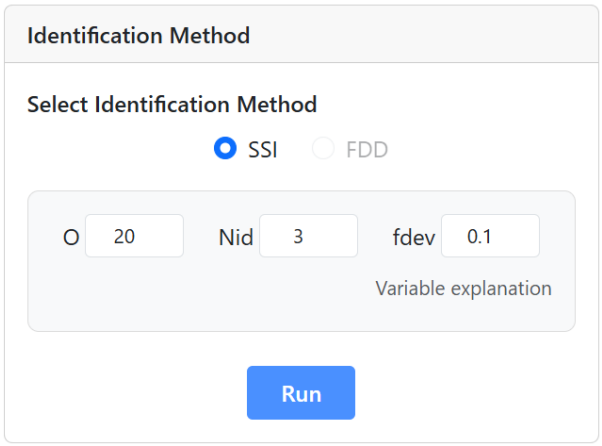
Inputting Parameters

Input the parameters for the analysis.

For SSI, the main parameters are

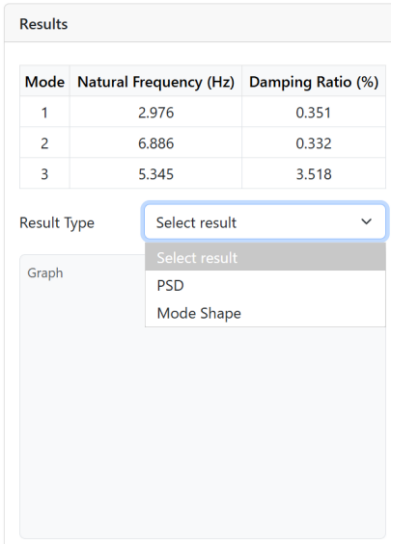
- O: Model Order Parameter, which controls the model order used in the SSI calculation.
- Nid: Number of Identified Modes, which defines the number of identified modes to extract. The maximum number of identified modes is currently 3.
- fdev: Frequency Deviation Tolerance, which defines the tolerance for frequency deviation during modal identification.

After entering the parameters, press “Run” to run the analysis. Depending on the data size and selected parameters, the calculation may take some time.

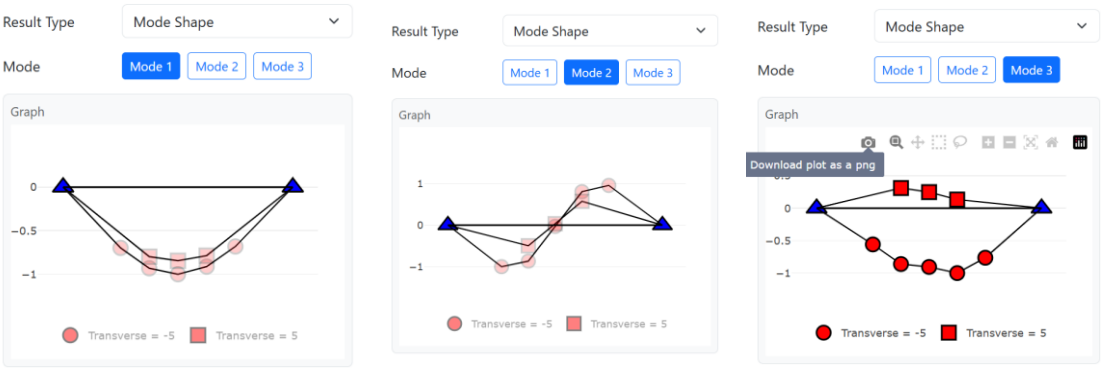


Checking Results

The results will be displayed in the Results panel. The table shows natural frequency and Damping ratio of each mode. From the “Select Result” dropdown menu, available results type can be selected. PSD is currently under development.

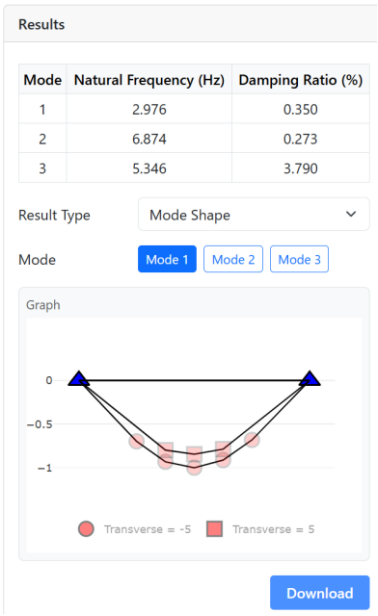


When selecting Mode Shape, the mode shape of the first mode will be shown as a default. Modes 1 through the specified Nid value can be displayed by clicking the number of modes above the graph. The graph can be downloaded as png. Other options such as zoom in and zoom out are also available.



Downloading Results

The results can be downloaded in CSV format by pressing the “Download” button below the graph. For SSI, the downloaded CSV contains natural frequency, damping ratio and mode shape.



	A	B	C	D	E	F	G
1	SSI Summary						
2	Mode	Natural Fı	Damping Ratio (%)				
3	1	2.976095	0.35108				
4	2	6.886158	0.331928				
5	3	5.345304	3.517552				
6							
7	Mode Shape						
8	Sensor ID	x (m)	y (m)	Column	Mode 1	Mode 2	Mode 3
9	1	14	-5	1	-0.69767	-1	-0.55822
10	2	21	-5	2	-0.93191	-0.8655	-0.86076
11	3	28	-5	3	-1	-0.03014	-0.90554
12	4	35	-5	4	-0.91227	0.806619	-1
13	5	42	-5	5	-0.6814	0.956663	-0.76352
14	6	21	5	6	-0.79833	-0.49533	0.310499
15	7	28	5	7	-0.84522	0.034829	0.247875
16	8	35	5	8	-0.78692	0.574774	0.133194
17							
18							

If an Error Occurs

Please reload Chrome or Edge, then start again by uploading the data.

If possible, please take a screenshot of the screen where the error message appears and send it to the email address below:

kawabe.daigo.2r★kyocenseo.co.jp

(Please replace the ★ with @.)

Use the subject line: **[SSI Site Error]**.