Manual of Power Inductors loss simulator for Automotive application

ver 1.0

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<Update History>

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1. What is the Power Inductor loss simulator for automotive application?

The Power Inductor loss simulator for automotive application enables the simulation of losses and temperature rises according to the current for Panasonic's power inductors designed for automotive use.

2. Features

・Two types of conditions can be simulated: power circuit conditions and current waveform conditions.
・Two types of substrates can be simulated: a four-layer substrate (t:1.6) and a heat-isolating multilayer substrate.
・Simulation results can be exported as PDF

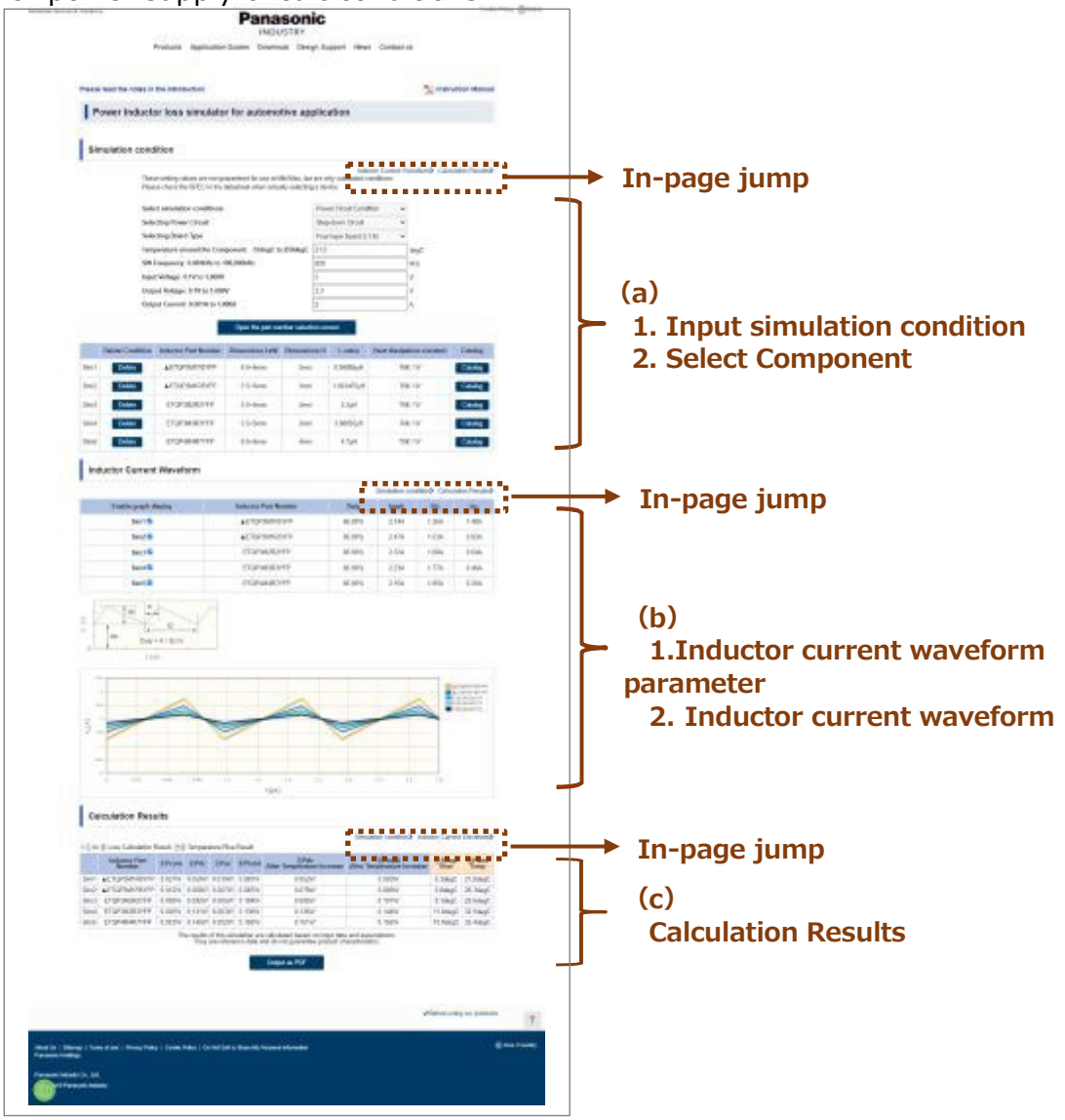
3. Overall Site Structure

The inductor loss simulator consists of three main sections.

The in-page jump function will take you to the place you want to browse.

(a) Tables for inputting simulation conditions or displaying information on selected part numbers.
(b) Inductor current waveform parameter、Inductor current waveform
(c) Calculation Results

For power supply circuit conditions



1. How to Use

4-1. Input simulation conditions.

Select simulation conditions from “power circuit conditions” or “current waveform conditions”.

① . When the simulation condition selection is “power circuit condition”

(1) For simulation input condition selection, select “power circuit condition.

(2) Select the power supply circuit from “buck circuit”, “boost circuit” or “step-up/step-down circuit”.

(3) Select the substrate type from “4-layer substrate (t:1.6)” or “high heat dissipation multilayer substrate”.

＊Different boards have different heat dissipation constants, resulting in different temperature rises of the components.

＊Calculated component temperatures (Temp. Rise & Parts Temp.) are lower for “high heat dissipation multilayer boards”.

(4) Enter the temperature around the component between “-55degC” and “250degC” using one-byte numbers.

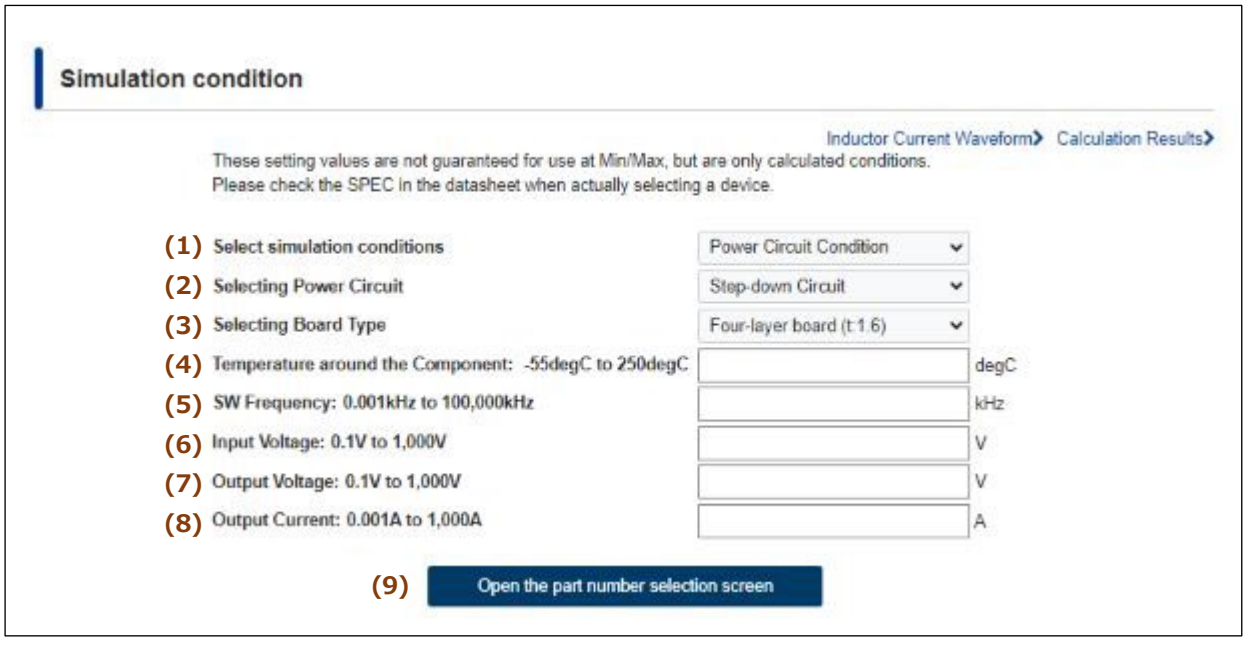
(5) Enter the SW frequency between “0.001 kHz” and “100,000 kHz” using one-byte numbers.

(6) Input the input voltage between “0.1V” and “1,000V” using one-byte numbers.

(7) Input the output voltage between “0.1V” and “1,000V” using one-byte numbers.

(8) Input the output current between “0.001A” and “1,000A” using one-byte numbers.

(9) Click the “Open Part Number Selection Screen” button. (The inductor parts list is overlaid on the screen.)



② **. When simulation condition selection is “current waveform condition”**

(1) Select “Current waveform condition” for input condition selection. (The parameter image of the current waveform is displayed.)

(2) Select the substrate type from “4-layer substrate (t:1.6)” and “High heat dissipation multilayer substrate”.

＊Different boards have different heat dissipation constants, resulting in different temperature rise of components.

＊With a “high heat-dissipating multilayer board,” the calculated component temperatures (Temp. Rise & Parts Temp.) will be lower.

(3) Enter the temperature around the component between “-55degC” and “250degC” using one-byte numbers.

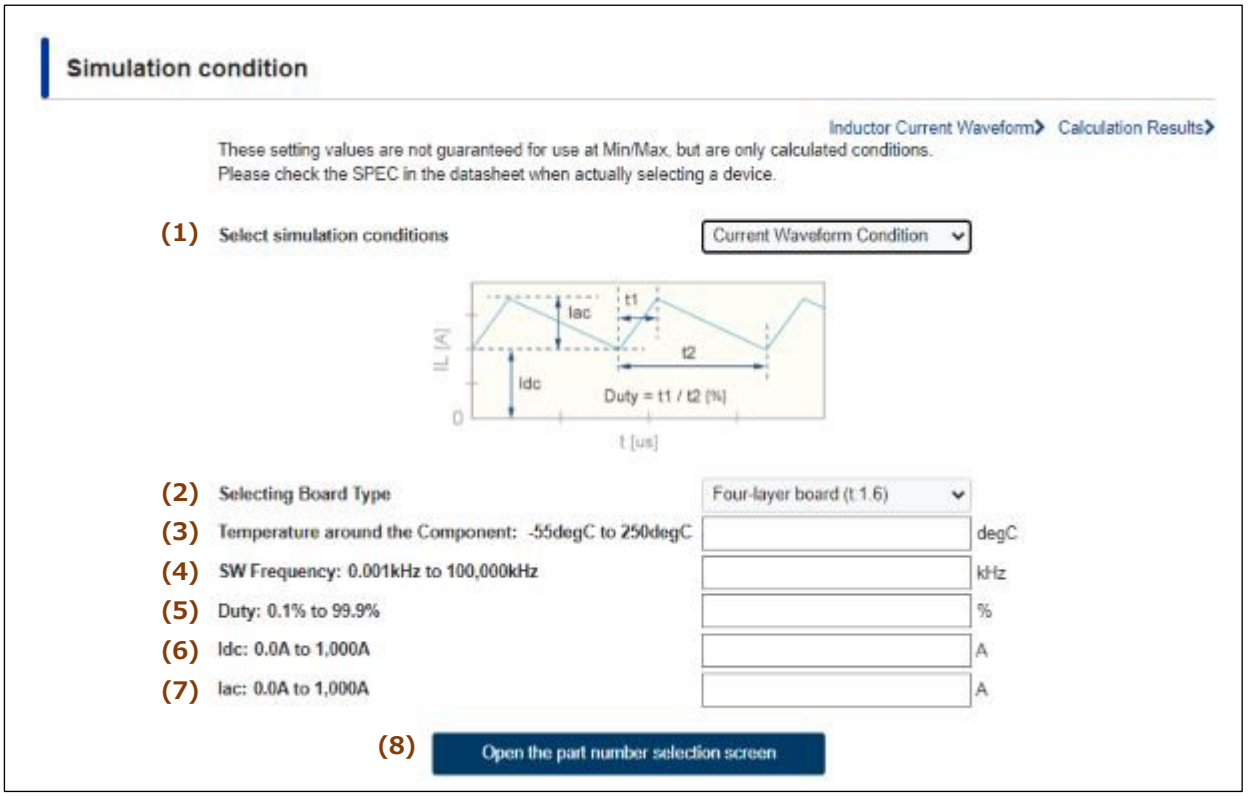
(4) Enter the SW frequency between “0.001 kHz” and “100,000 kHz” using one-byte numbers.

(5) Enter “Duty” as a one-byte number between “0.1%” and “99.9%”.

(6) Enter Idc between “0.0A” and “1,000A” using one-byte numbers. (Idc+Iac=0.0A cannot be set.)

(7) Enter Iac between “0.0A” and “1,000A” using one-byte numbers. (Idc+Iac=0.0A cannot be set.)

(8) Press the “Open Part Number Selection Screen” button. (The inductor parts list is overlaid on the screen.)



4-2. Select the part number.

Select the inductor component to simulate.

Press the Close button in the upper right corner of the screen to close the screen.

(a) Select a parameter in the drop-down to narrow down the part numbers in the part number information area. Pressing the Reset button will initialize the drop-down.

(b) Part number search allows you to narrow down the part numbers in the part number information area.

(c) 1. Check the part number to be simulated in (d) and press the Select Part Number button in (c)1.

If you press the Close button without pressing the Select Part Number button, the following message will be displayed.

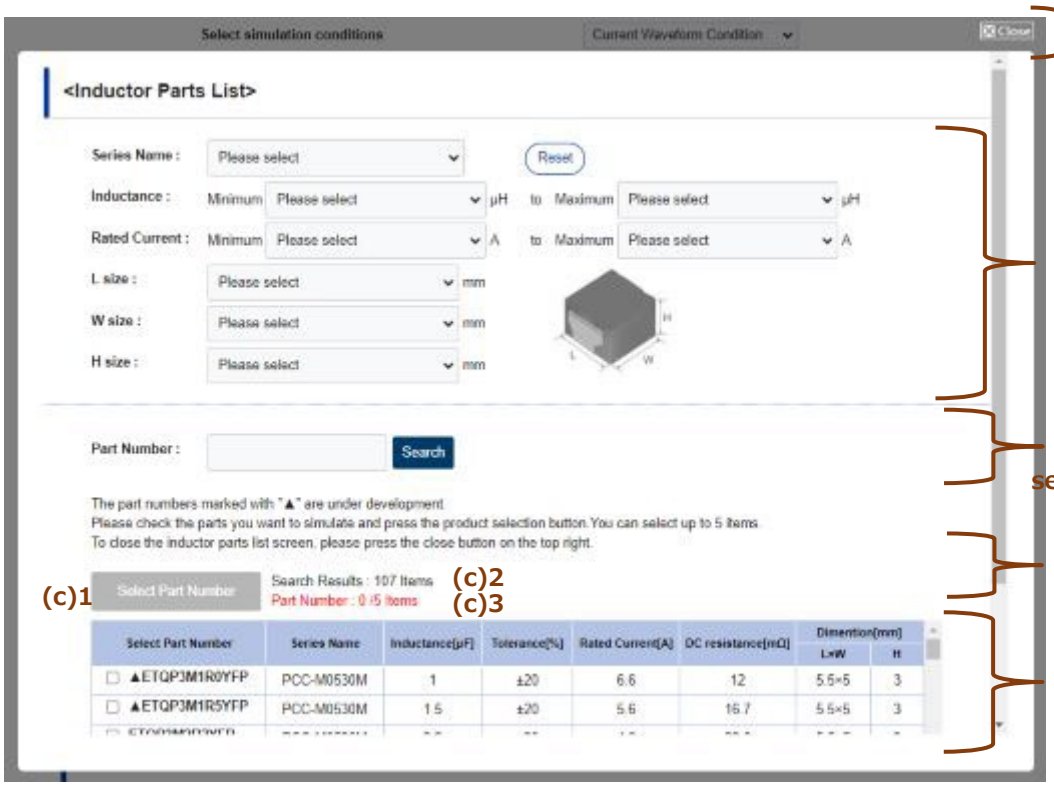
The part number has not been selected. Are you sure to close the inductor parts list?

If you press Yes, the screen is closed without keeping the checked part number.

2.The number of search results of inductor parts. The number of results will change when (a) and (b) are executed.

3.The number of part number selections. Check (d) and click the “Select part number” button to change the number of items.

(d) Part number information area. Check the checkbox for the part number to be simulated.



4-3. Flow of inputting simulation conditions and selecting part numbers

Set the simulation conditions by following steps (a) to (d)

(a) Set the simulation conditions

(b) Press the button to open the part number selection screen to overlay the inductor parts list.

(c-1) Narrow down the part numbers in (c-2) Part Number Information Area by selecting parameters or searching for part numbers.

(c-2) From the part number information area, check the part number you want to simulate and press the Select Part Number button.

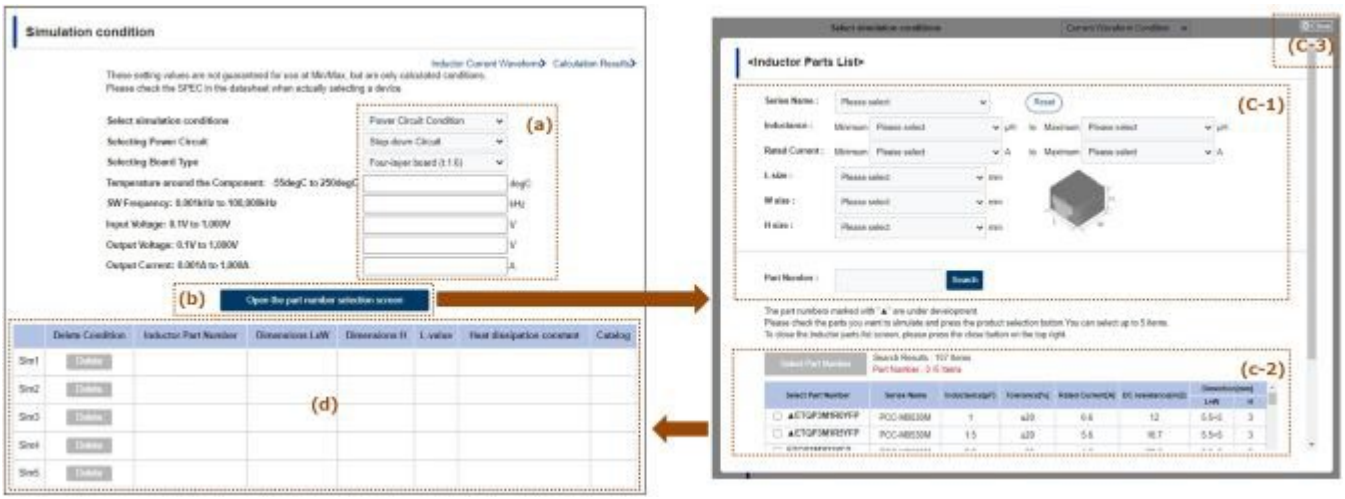
※The number of cases that can be checked in (c-2) is as follows

- Part number selection: 0/5 case･･･Selection limit of 5 – Part number selected 0 = 5 selections available
- Part number selection: 2/5 case･･･Selection limit of 5 – Part number selected 2 = 3 selection available
- Part number selection: 5/5 case･･･Selection limit of 5 – Part number selected 5 = Selection not allowed

(c-3) Press the Close button to close the inductor parts list.

(d) Displays the part number information selected in the inductor parts list.

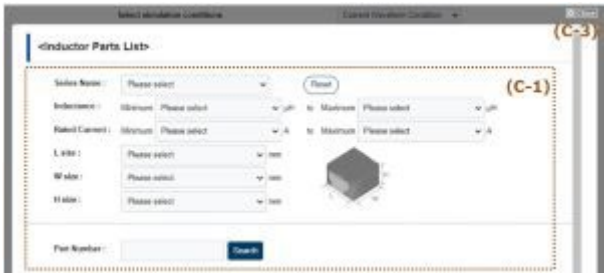
- The Delete button deletes the selected part number in the inductor parts list.
- Clicking the Catalog button will display the catalog for the part number in question in a separate URL.



From the next page, the flow of setting simulation conditions and selecting part numbers will be explained.

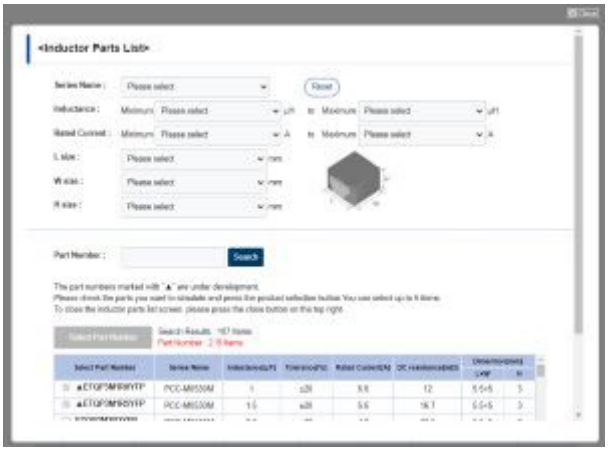
4-3. Flow of inputting simulation conditions and selecting part numbers

《① . Case with part number selection from 0 to 2》

No	Details	Display
1	Select and enter simulation condition parameters.	
2	Press the button to open the part number selection screen. (The inductor parts list will be overlayed.)	
3	Select a parameter or search for a part number to narrow down the part numbers in the part number information area.	
4	Check the part number to be simulated. (In this explanation, we will check two cases.)	
5	Press the Select Part Number button. (Part number: 0/5 will change to Part number: 2/5)	
6	Press Close button. (The inductor parts list is closed and the two selected part numbers are displayed.)	

4-3. Flow of inputting simulation conditions and selecting part numbers

《② . Case with part number selection from 2 to 5》

No	Details	Display
1	Press the button to open the part number selection screen to overlay the inductor parts list. (The two part numbers already selected will have a gray check mark.)	
2	Check the part number to be simulated. (Part number: 2/5 items, so you can check the remaining 3 items. In this explanation, we will check 3 items.)	
3	Press the Select Part Number button. (Part number: 2/5 items will change to Part number: 5/5 items)	
4	Press Close button. (The inductor parts list is closed and the three selected part numbers are displayed in Sim3 to Sim5.)	

*If you want to re-set part numbers after selecting 5, please refer to the next page 《③. Case with part number selection from 5 to 4》.

4-3. Flow of inputting simulation conditions and selecting part numbers

《③.Case with part number selection from 5 to 4》

No	内容	表示
1	Press the Delete button for the condition you wish to delete. (In our explanation, we will delete Sim2.)	
2	When the Delete button is pressed, the information in Sim2 disappears and the information displayed in Sim3 to Sim5 is moved up from Sim2 to Sim4.	
3	To select a new part number, press the Open Part Number Selection Screen button to overlay the inductor parts list. Part No.: 4/5 items, so you can check one remaining item. (By pressing the Delete button in Sim2, the part number that was set in Sim2 will be unchecked.)	

This is the end of the simulation input and part number selection process.

Simulation results will be explained from the next page.

4-4. Simulation Results

When all setting of conditions input and part number selection are completed, the inductor current waveform and calculation result will be displayed.

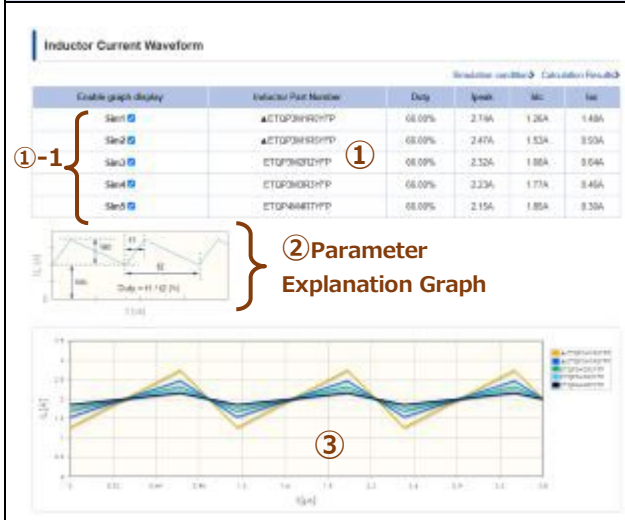
《Inductor current waveform》

・①Inductor current waveform parameters, ②Parameter explanation graph, and ③ Current waveform graph are displayed.

・Uncheck the Graph Display ON checkbox in ①-1 to hide the current waveform graph for that part number.

・②The parameter explanation graph is displayed when the simulation condition is a power circuit.

・③Hovering the cursor over a graph vertex displays the X-axis and Y-axis values.

Power supply circuit	Current waveform
	

《Calculation Results》

・④Displays the results of loss calculation and temperature rise of the components.

・⑤Click the PDF output button to download the simulation results in PDF format.