Project Settings for PSCAD Simulation

Written for PSCAD v4.5 and v4.6

This document describes important *Project Settings* features for PSCAD simulation and provides some recommendation on how to choose appropriate values to get accurate simulation results.

Also the *Ideal Branch algorithm* and conditions for enabling/disabling is presented. The examples will be provided based on LR series circuit connected to an ideal voltage source.

> **Note**
> For all available *Project Settings* features and parameters please refer to Chapter 7 of the PSCAD User's Guide.

1.   Introduction

Most features and settings related to simulation control in PSCAD are contained within the *Project Settings* dialog. This dialog can be accessed through a right-click on the project title itself (either a case or a library) in the workspace window, and selecting *Project Settings* from the pop-up menu. Or it can be found in the main ribbon from project as shown in Figure 1.
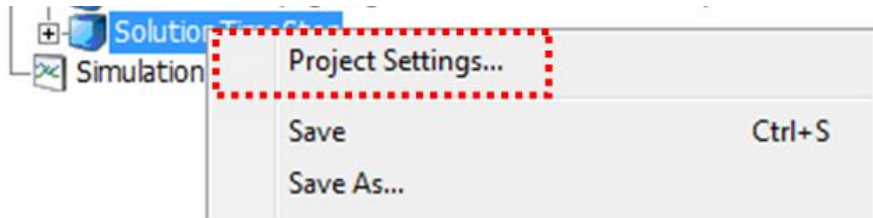
(a)
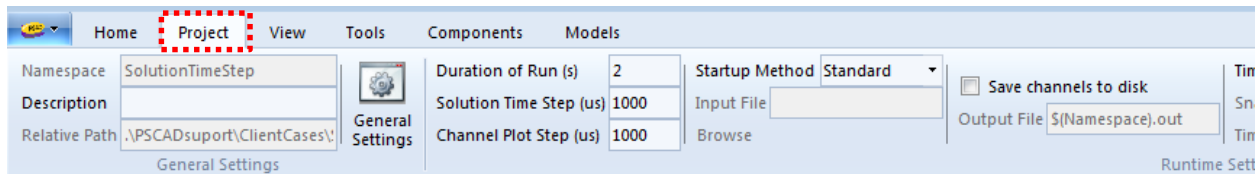
(b)

Figure 1 : Project settings for PSCAD simulation through (a) right-click on the project title (b) the main ribbon.

In order to obtain accurate simulation results the following settings must be considered carefully:

- Solution time step and
- Channel Plot time step
- Use Ideal Branches for Resistances

These settings are available in *Runtime* tab and *Simulation* tab of *Project Settings* dialog respectively as shown in Figure 2.
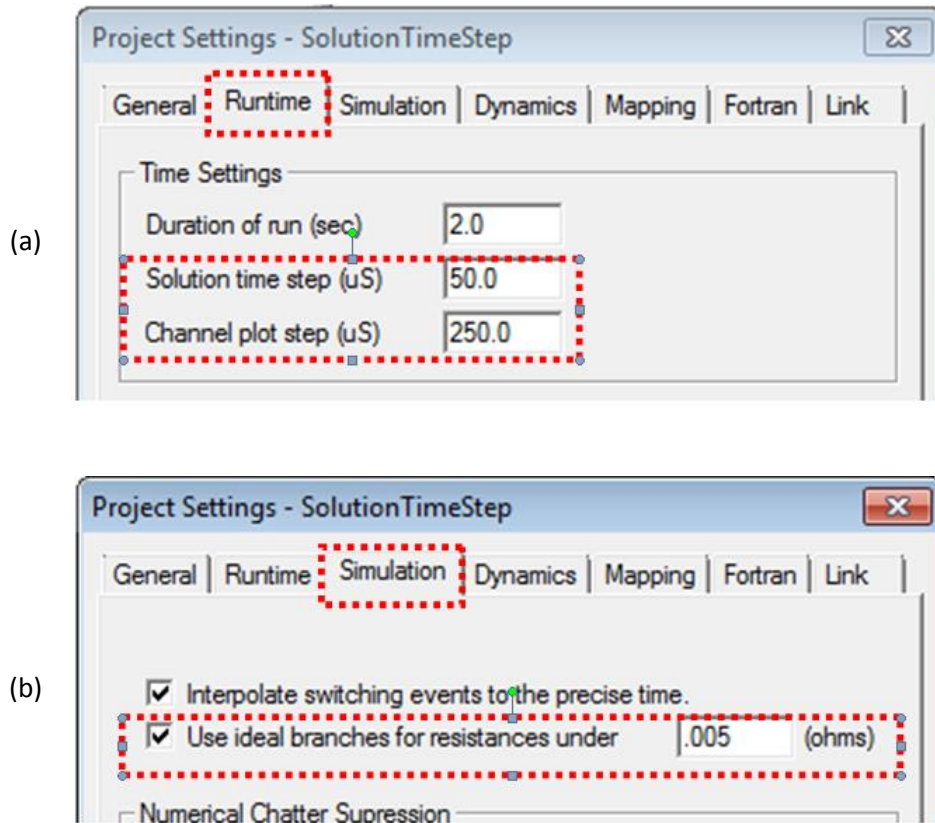
(a)

(b)

Figure 2: Project settings: (a) Solution time step and Channel Plot time step,
(b) Use Ideal Branches for Resistances.

2.   General Recommendations for Project Settings

2.1   Solution Time Step (µs):

This is the EMTDC simulation time step, entered in microseconds. The default is 50 µs, which is a typical step for most practical circuits. However, users may make sure that the time step selected is suitable for their simulation. The general recommendation for the *Solution Time Step* (µs) is to choose value smaller than the smallest time constant in the circuit, as well as smaller than the period (T=1/f_{system}) of the sources to obtain accurate simulation results.

2.2   Channel Plot Step (µs):

This is the time interval at which EMTDC sends data to PSCAD for plotting, as well as writing data to output files. It is always an integer multiple of the EMTDC simulation time step. Usually a 250 µs plot step provides a reasonable resolution. The *Channel Plot Step* is equal or multiple of the *Solution Time Step* (see suggestions in the previous section).

As a basic rule, if you are in a process of debugging the case or simulation results are not acceptable, run the case with *Channel Plot Step* equal to *Solution Time Step*.

Smaller sampling intervals (higher sampling rate) can decrease the simulation speed considerably due to an excessive transfer of data from EMTDC to PSCAD (without adding much to the plot resolution). If the sampling interval is too large, the waveforms may appear unstable.

2.3 Use Ideal Branches for Resistances Under:

The Ideal Branch option allows a non-zero resistance value greater than this threshold, unless the resistances smaller than threshold are considered ideal branches by PSCAD. Hence, before activation the Ideal Branch algorithm it is necessary to analyze the Circuit parameters to be sure that resistance value exceeds the threshold.

3. Circuit Description

All the discussed parameters are analysed using example (CircuitExample.pscx) of basic LR series circuit connected to ideal voltage source presented in Figure 3.
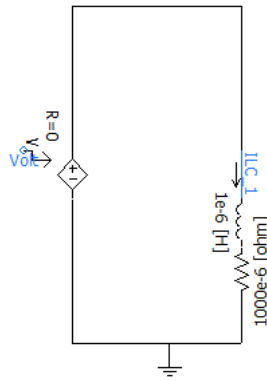

Figure 3: The LR Series circuit

The time constant of the given LR series circuit is:

$$\tau = \frac{L}{R} \tag{1}$$

$$\tau = \frac{1*10^{-6}[H]}{1000*10^{-6}[Ohms]} = 0.001s = 1 \text{ ms}$$

4.   Simulation Results

Two simulations are conducted to examine the discussed parameters effect on the simulation results.

1.   Simulation 1: Simulation results when Ideal Branches threshold is 0.0005 Ω and *Solution Time Step* and *Channel Plot Step* are examined.

2.   Simulation 2: Simulation results when *Solution Time Step* and *Channel Plot Step* are chosen correctly but *Ideal Branches* threshold is 0.005 Ω.

4.1   Simulation 1: Effect of Solution Time Step and Channel Plot Step

In this simulation the *Solution Time Step* is selected equal to 10 ms (bigger than the smallest time constant in the circuit i.e. 1 ms see (1)) and then changed to 0.1 sec (smaller than 1 ms). The *Channel Plot Step* is selected equal to 10 ms and then changed to 0.1 sec.

In this simulation the *Ideal Branches* threshold is 0.0005 Ω.

Figure 4 shows the simulation results for the *Solution Time Step* 10 ms and *Channel Plot* Step is 10 ms. This leads to not accurate results.

Figure 5 shows the simulation results for the *Solution Time Step* 0.1 ms and *Channel Plot Step* is 10 ms are not accurate.

Figure 6 shows the simulation results for the *Solution Time Step* 0.1 ms and *Channel Plot Step* is 1 ms are accurate.
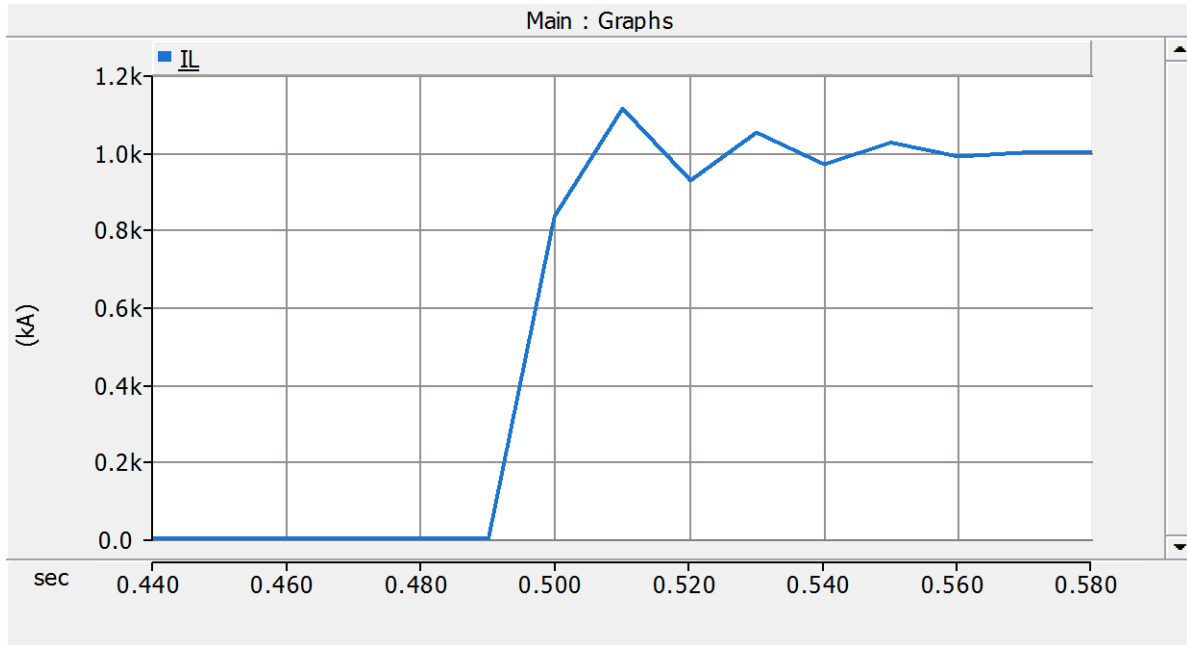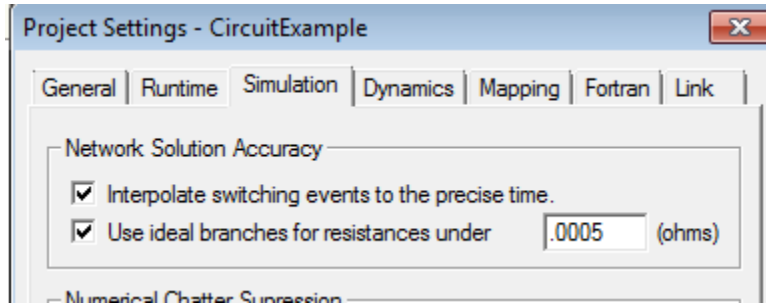
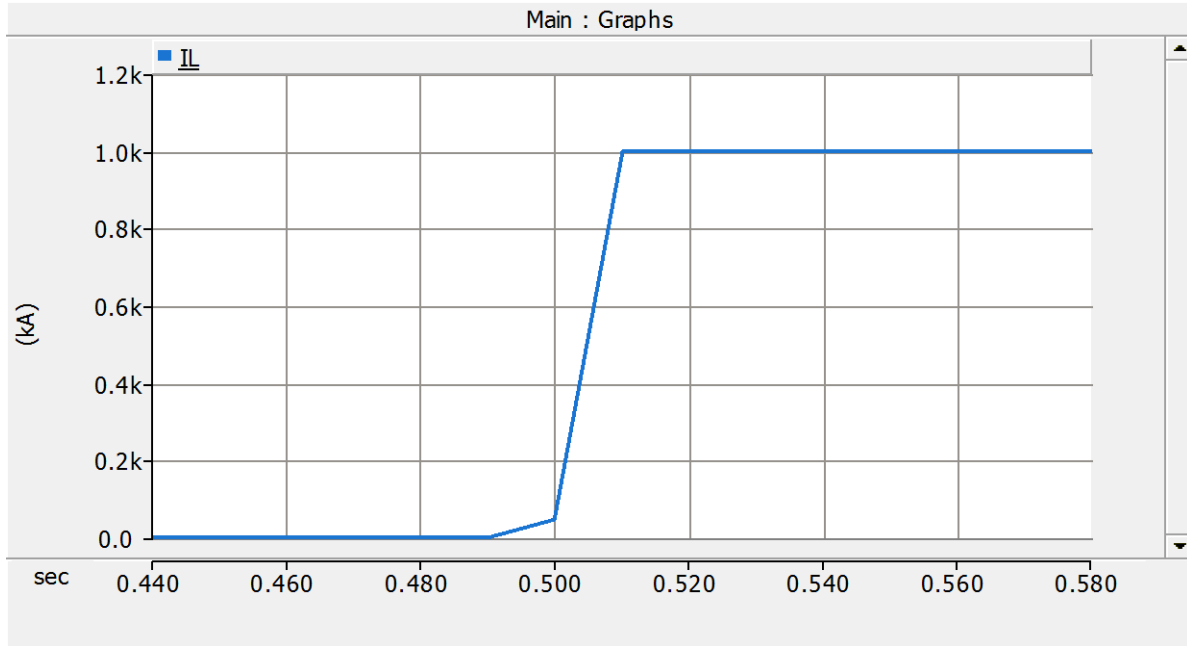*Figure 4: Simulation results for Solution Time Step and Channel Plot Step equal to 10 ms*

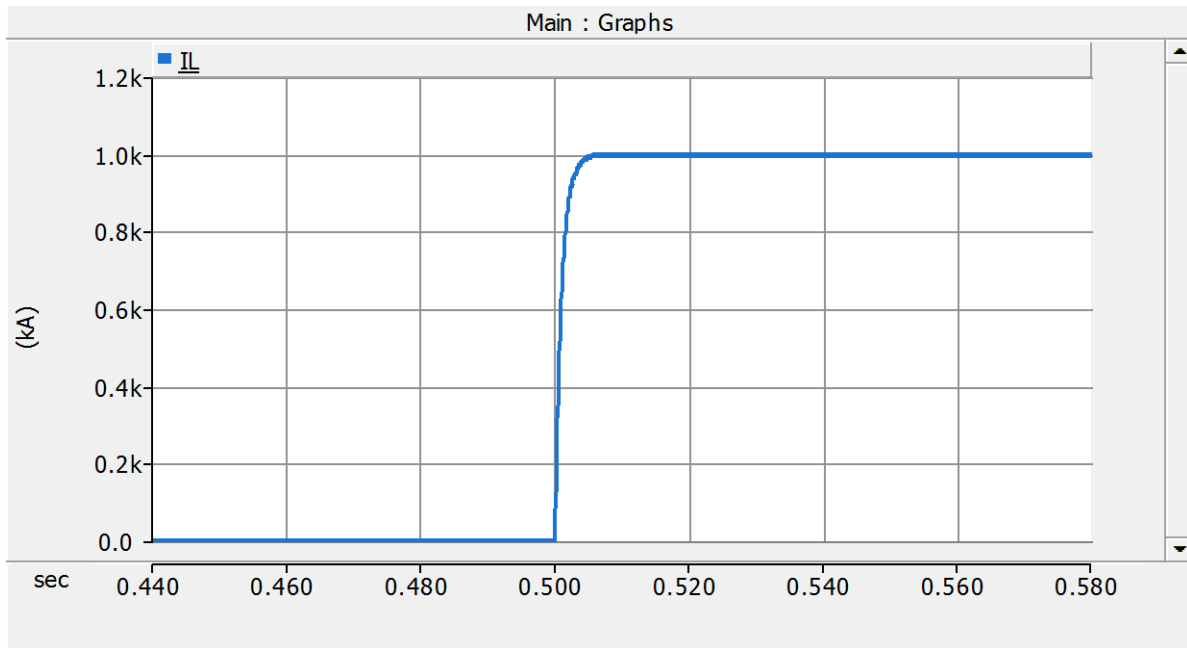*Figure 5: Simulation results for Solution Time Step 0.1 ms and Channel Plot Step to 10 ms*

Figure 6: Simulation results for Solution Time Step and Channel Plot Step equal to 1 ms

4.2 Simulation 2: Effect of the Ideal Branch option

Figure 7 shows the *Ideal Branch* threshold is equal to 0.005Ω and *Solution Time Step* and *Channel Plot Step* equal to 1 ms and 0.1 ms respectively. The simulation results are not correct because PSCAD considers the resistance branch as ideal.
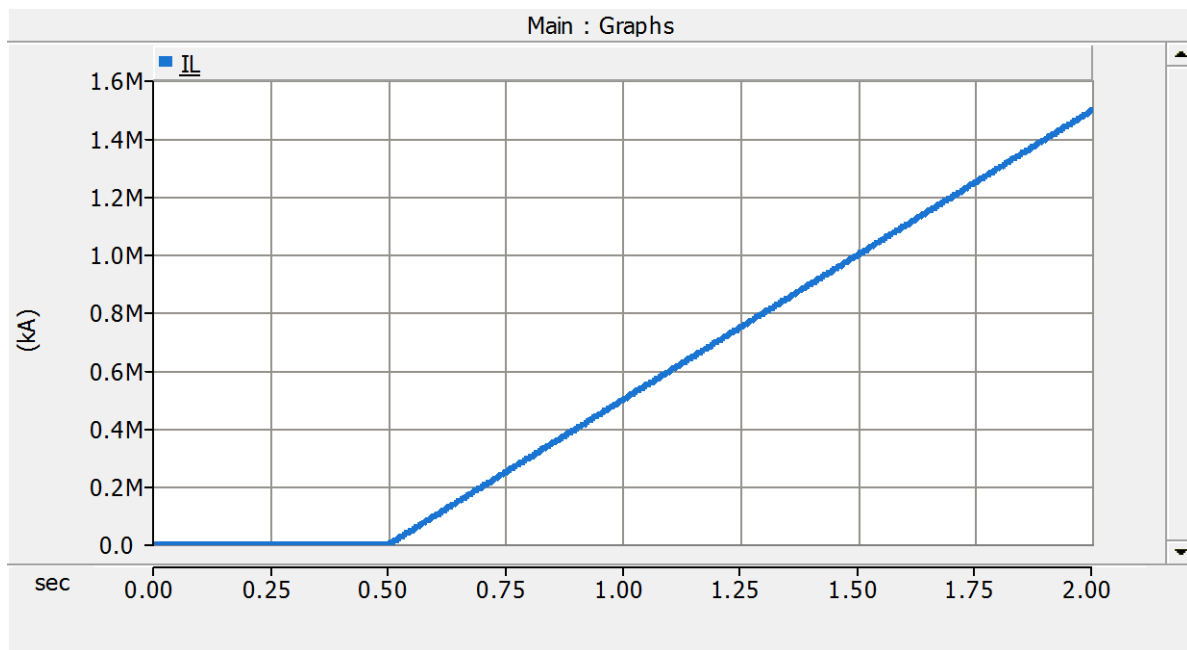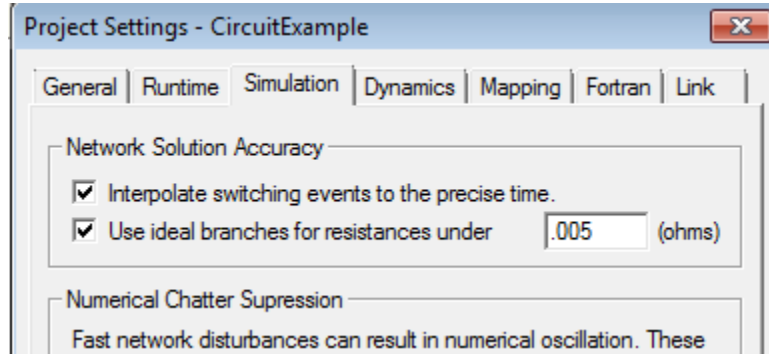

Figure 7: Simulation results when the Ideal Branch threshold is equal to 0.005Ω and Solution Time Step and Channel Plot Step equal to 0.1 ms.