Requirements for Parallel Multiple-Run in PSCAD

Data Parallelism is supported in PSCAD in the form of Intelligent Parallel Multiple-Run (PMR-I) and Parallel Multiple-Run (PMR) features.

The Intelligent Parallel Multiple-Run (PMR-I) feature launches and runs a single project multiple times, with each run evaluating different conditions over multiple cores simultaneously, all on one or more computers. Multiple-run simulations launched in parallel can result in a significant increase in simulation speed overall. The simulations are tied back to a Master simulation which controls the distribution of parameters to the simulations.

A simplified version known as Parallel Multiple Run (PMR) is developed (available in V5.0), which removes the requirement of tying back to the Master simulation. Using the Rank Number component, the simulations can be configured to run in batches (in parallel) until the desired number of runs is consumed.

The number of processor cores that can be used in a PMR-I and PMR study depends on the number of "parallel simulations" programmed on your PSCAD license. A standard v5.0.2 license, for example, will allow up to a maximum of eight parallel simulations to be run over eight processor cores. Additional parallel simulation capabilities are available for purchase via our Sales Desk (sales@pscad.com).

Table 1 lists the number of parallel simulations available for both certificate and lock-based licensing.

PSCAD version	Certificate licensing		Lock-based licensing	
	Default	*Purchase additional parallel simulations*	*Default*	*Purchase additional parallel simulations*
v4.6.0 (PMR-I)	8 parallel simulations	Yes (max. 64)	4 parallel simulations	No
v4.6.1 (PMR-I)	8 parallel simulations	Yes (max. 64)	4 parallel simulations	Yes (max. 64)
v4.6.2 to v4.6.3 (PMR-I)	8 parallel simulations	Yes (max. 64)	8 parallel simulations	Yes (max. 64)
v5.0.x (PMR-I and PMR)	8 parallel simulations	Yes (max. 64)	8 parallel simulations	Yes (max. 64)

Table 1: Available Parallel Simulations

Running on a Single Computer

When PMR-I or PMR is performed on a single computer, the optimal ratio of parallel simulations to cores is 1½:1, with a maximum of 2:1. Table 2 specifies the optimal and recommended ratios.

Desired number of parallel runs	Licensed capabilities	Single computer		Multiple computers
		Number of computer cores		Optimal number of computer cores
		Optimal	*Recommended Minimum*	
8	8 parallel simulations	5	4	8
16	16 parallel simulations	10	8	16
32	32 parallel simulations	21	16	32
64	64 parallel simulations	42	32	64

Table 2: Recommended Number of Parallel Simulations and Computer Cores

Hyper-threading, may affect the performance of PMR-I or PMR simulations. However, the choice of trade-off between using just the physical cores (by turning off Hyper-threading) and effect in performance due to Hyper-threading depends on the user's choice and comfort.

Running over Multiple Computers

When a PMR-I or PMR is performed over multiple computers, the optimal ratio of parallel simulations to cores is 1:1. Table 2 specifies the optimal and recommended ratios.

The Cluster Launch System (CLS) may be used for coordinating simulations over multiple computers. Separate PSCAD licenses are not required on each connected computer; only one PSCAD license is required.

For details on data parallelism and other high performance computing features, please refer to the article Parallel and High Performance Computing.