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Comparison of PSIM & MATLAB-Simulink Usage in Outcome-based Teaching- Learning of Power Electronics based Courses

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Abstract - In response to the current COVID situation, educators have been instrumental in finding new ways to ensure learning continues for students. Especially Virtual /online education in Engineering might be relatively a new concept in India, but we are experiencing a new trend of the blended learning model gaining popularity. Online education is not just about taking a lesson through a video conferencing tool; it involves more than that. This helps learning to continue beyond the four walls of the classroom and has opened up possibilities of rethinking the way we are doing teaching & learning. The use of engineering educational and research simulation tools like PSIM, MATLAB can begin to transform the classroom.

This paper presents a comparison analysis between two engineering software platforms, MATLAB/Simulink & PSIM, which are used as major educational tools in teaching of power electronics, electrical drive courses and power quality and FACTs etc,

***Key Words*: simulation, PSIM, MATLAB, simulink**

1. INTRODUCTION

Engineering education is an important component of undergraduate courses. It deals with development of practical ability, knowledge ability, analytic ability and research ability of students. Engineering education also provide ability to identify and solve critical engineering problem related to society, industries etc… For country like India, engineering education play vital role for economic growth and industries development.

National board of accreditation (NBA) is interested for quality based and outcome based engineering education. Many educators have already started to use effective education tools for outcome based teaching learning. All the engineering courses are important equally but some course of electrical engineering play vital role in developing some valuable skill

in students useful for industrial growth and hence country development too. Some of the subject are Facts devices, power quality, renewable power generation, electrical drive, power electronics, etc..

In today's online mode of education, electrical engineering educators are using several software packages like PSIM, MATLAB, ETAP, multisim, Pspice etc… Use of these softwares in such courses resulted in better teaching outcomes and increased student's engineering ability even in a time of online education.

2. STUDENT LEARNING WITH SIMULATION STUDY.

Challenges: - Now a day, it is strictly needed to move from teacher centered learning method to student centered learning method by including students in participating class Activity, designing and finishing course projects in groups or individual for outcome base education.

To achieve this, educator have started to take advantage of software tool suitable for Electrical or power electronic based subject.

This paper describes modeling of some power electronics circuits by using MATLAB/Simulink and PSIM with respect to output quantities, switch Techniques and special function block for the following circuits:

- Harmonic Analysis of 3 phase nonlinear load along with linear load on same point of coupling;
- Behavioral study of TCR type SVC under different firing angle;
- V/F control of 3 ph induction motor;

3. MODELLING AND SIMULATION

3.1 Harmonic Analysis of 3 phase nonlinear load along with linear load on same point of coupling

The circuit for both simulation environment are given below. Where on a same point of coupling linear and nonlinear load are connected with 3 ph AC source of 400 V, 50 Hz. Now a days due to fast growth in electronic devices technology, non linear load increased at considarable level. Due to their involvement in power quality issues, harmonic analysis is useful.

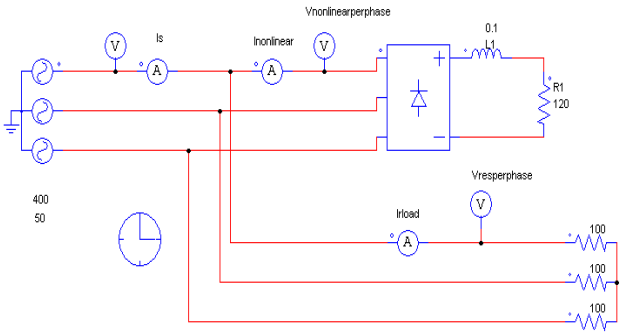

Figure 1. PSIM circuit for harmonic study

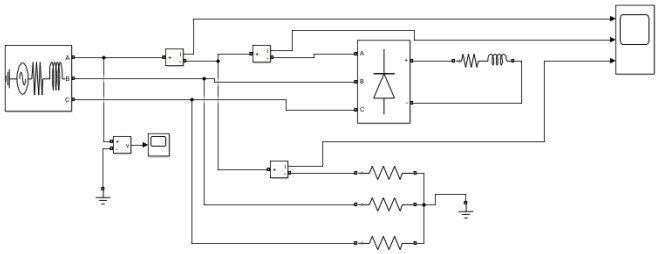

Figure 2. MATLAB-Simulink model for harmonic study

Table - 1: Comparison Analysis based on Harmonic Simulation

Parameter	PSIM	Simulink
Model Building	Simple	Slight complicated
Graph /scope	Meters itself use as scope or graph	Separate scope is required to connect.
simulation run time for 10 cycle	Quick run is possible	Take more time compare to PSIM
Source current THD	18.8 % through inbuilt THD block	12.64% using FFT analysis tool
Source voltage THD	Very less	10.42 %
FFT Analysis	Easy but not too accurate	Not easy but Accurate due to all practical parameter consideration

3.2 Behavioral study of TCR type SVC under different firing angle.

The circuit for this title is shown below for both simulation environments. Inductance of 0.01 H is connected with 230 V (Peak) through back to back connection of Thyristors switch. TCR arrangement help to compensate reactive power at the time of light load by consuming sufficient reactive power concern with load condition. This can be done smoothly with help of Firing angle control of Thyristors.

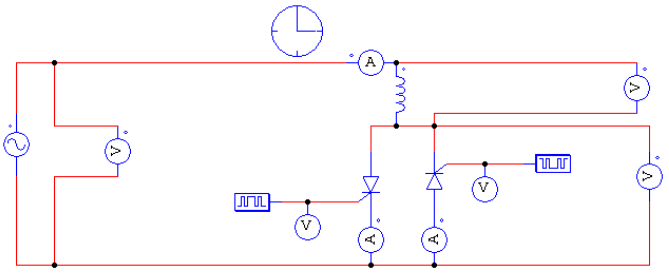

Figure 3. PSIM circuit for TCR type SVC simulation

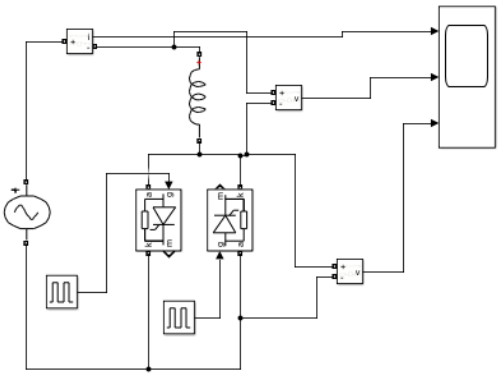

Figure 4. MATLAB-Simulink model for TCR types SVC simulation

Table - 2: Comparison Analysis based on TCR Simulation

Parameter	PSIM	Simulink
Model Building	Easy	Slight complicated
simulation run time for 10 cycle	Fast	Comparatively slow

Gate pulse setting	Very easy as only switching point is required to assign	Not too easy as other precise details required to assign.
THD for alpha=150	11% in line current	13%in line current
Other feature	Pulse generator block is available	Pulse generator and repeating signal block both are available.

3.3 V/F control for 3 ph induction motor.

The circuit for both simulation environment are given below. Where on a same point of coupling linear and nonlinear load are connected with 3 ph AC source of 400 V ,50 hz. Now a days due to fast growth in electronic devices technology, non linear load increased at considarable level. Due to their involvement in power quality issues ,Harmonic analysis is useful.

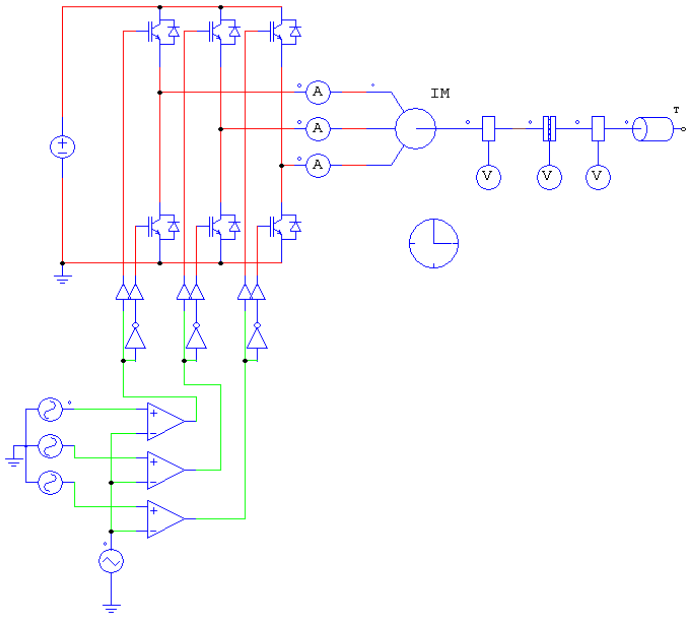

Figure 5. PSIM circuit for V/F control

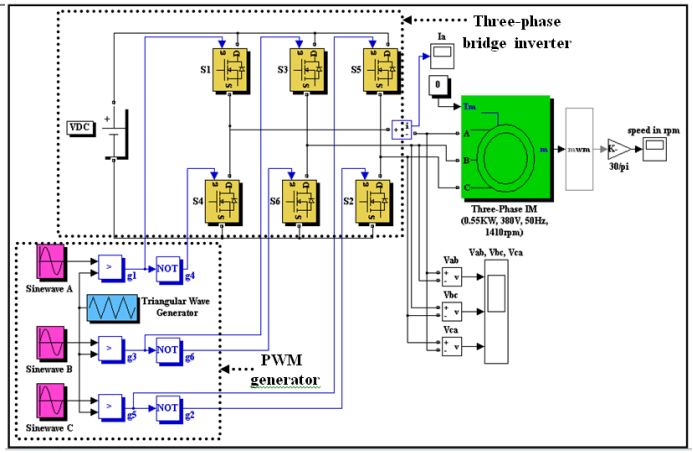

Figure 6. MATLAB-Simulink model for V/F control

Table - 3: Comparison Analysis based on V/f control Simulation

Parameter	PSIM	Simulink
Model Building	Easy	Slight complicated
simulation run time for 10 cycle	Fast	Comparatively slow
PWM setting	Easy	Easy with more options for setting
Speed sensor output	Ideal speed graph is available	Practical speed graph is available
Shape of waveform with same pwm setting	Smooth shape show low THD.	distortive shape show more THD.

CONCLUSIONS

The following conclusion may be from comparison

- Both software platforms have their strengths and weaknesses.
- With respect to the educational point of view, PSIM is simple tool for simple learning than MATLAB/Simulink.
- With respect to the research and project point of view, Simulink has advanced features and special tools which increase its functionality and simulation capability.
- It is recommended that both these two platforms can be used to gain course efficiency and course outcome of all subjects and may be more as mention in this paper.

References:

[1] MATLAB/Simulink User's Guide, 2010b www.mathwork.com
[2] PSIM, User;'s Guide, 2009, www.powersim.com
[3] Bülent Ertan H., "A Report on the Evaluation of PSIM and Some Other Possibilities for Power Electronics Circuit Simulation", 2007.
[4] Armata J.M, Besrest B., Pauly R.,"PSIM/MATLAB co-simulation for electrical architectures global models", AES 2005
[5] Rashid M., "Power Electronics: Circuits, Devices and Applications", Prentice-Hall, 2004, Transactions on Applied Superconductivity, 1051-8223
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