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ICVEE

2020 the third International Conference on Vocational Education and Electrical Engineering (ICVEE)

Strengthening the framework of Society 5.0 through Innovations in Education, Electrical, Engineering and Informatics Engineering

IEEE Catalog Number : CFP20X27-ART
ISBN : 978-1-7281-7434-1

3-4 OCTOBER 2020
UNIVERSITAS NEGERI SURABAYA

VITUAL EVENT
SURABAYA - INDONESIA

http://icvee.conference.unesa.ac.id

2020 the third International Conference on Vocational Education and Electrical Engineering (ICVEE)

Proceeding

2020 the third International Conference on Vocational Education and Elecrical Engineering (ICVEE) on October 3-4, 2020 in the virtual event, Surabaya, Indonesia.

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Conference Record Number 50212

Message from the General Chair

It gives me great pleasure to all of the keynote/invite speakers, distinguished guests, and ICVEE participants, welcome to 2020 the third International Conference on Vocational Education and Electrical Engineering (ICVEE). Due to the COVID-19 ICVEE conference which is organized by the Department of Electrical Engineering and Departement of Informatics, Universitas Negeri Surabaya and technical sponsorship IEEE Indonesia section hold the conference in the virtual event. The theme of our conference is " Strengthening the framework of Society 5.0 through Innovations in Education, Electrical Engineering, and Informatics Engineering".

This year we receive 134 articles and resulted in 71 articles that have been presented at this conference and will be submitted to the IEEE explorer. The article comes from some domestics and international universities. The International author and co-author come from Brazil, Jerman, Philippines, Japan, Taiwan, Singapore, Malaysia, Thailand, Saudi Arabia, and Australia. We would like to appreciate all of the keynotes and invite speakers, reviewers, committees, and participants for all the support and participation. We would like to give gratitude to the Universitas Negeri Surabaya as the organizer and IEEE Indonesian Section as a technical Co-sponsorship.

Finally, I wish all participants always successful and enjoy this conference. I hope this program will be interesting and useful for all the ICVEE participants.

Prof. Dr. Bambang Suprianto., MT

General Chair

Organizer and committee

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General and Paralel Program Schedule

General Timetable ICVEE
Saturday, October 3-4, 2020

No	Activity	Time	Duration	PIC	Necessity
Plenary Session Sat, Oct 3					
1	Online Registration (Technical meeting Preparation and On the Spot registration)	07.30 – 08.00	30 minutes	Committee	**Laptop, internet**
2	Opening and Rules Guidance for the Virtual Conference	08.00 – 08.10	10 minutes	Committee	**Laptop, file, documentatior**
3	Viewing Profile Video of Universitas Negeri Surabaya, Listening Indonesia National Anthem, and Listening Mars of Universitas Negeri Surabaya	08.10 – 08.30	20 minutes	Committee	**Laptop, file, documentatior**
4	Welcoming Session	08.30 – 08.50	20 minutes	**Prof. Dr. Bambang Yulianto**., **M.Pd** Vice Rector I of Universitas Negeri Surabaya	**Laptop, file**
5	Keynote Speaker 1 (ICVEE)	09.00 – 09.30	30 minutes	**Prof. Takeshi Fukusako,** Professor at Kumamoto University, Japan	**Laptop, file**
6	Keynote Speaker 2	09.30 – 10.00	30 minutes	**Prof. Dr. Hadi Susanto**, Professor at University of Essex, UK and Khalifa University, UAE	**Laptop, file**
7	Keynote Speaker 3	10.00 – 10.30	30 minutes	**Prof. Johan Pion**, Professor at HAN University	
8	Live Discussion (Question and Answer)	10.30 – 11.15	45 minutes	Plenary Moderator	
Roundtable Discussion, Sat Oct 3, 2020 (ICVEE)					

No	Activity	Time	Duration	PIC	Necessity
9	Welcoming session from ICVEE chair	12.00-12.10	10 minutes	**Prof Bambang Suprianto., MT**	**Laptop, file**
10	Invited Speaker I	12.10 – 12.35	25 minutes	**Prof. Madya. Ir. Dr. Abd Kadir bin Mahamad** **Universiti Tun Hussein Onn Malaysia (UTHM) (Malaysia)**	**Laptop, file**
11	Invited Speaker II	12.35 – 13.00	25 minutes	**Prof. Mingchang Wu., Ph.D.** **National Yunlin University of Science and Technology (Taiwan)**	**Laptop, file**
11	Invited Speaker III	13.00 – 13.30	30 minutes	**Prof. Wisnu Jatmiko., Ph.D** **Universitas Indonesia (UI)** **(IEEE Indonesian Section chair)**	**Laptop, file**
10	Live Discussion (Question and Answer)	13.30 – 14.15	45 minutes	Plenary Moderator	
13	Rules Guidance for the Roundtable Discussion	14.15 – 14.30	15 minutes	Committee (IEEE-AP) (IEEE for room 1-8)	**Laptop, file**
14	Session of Roundtable Discussion	14.30 – 17.00		Room 1 – Room 8 (14.30-14.45) Room 1 – Room 8 (14.45-15.00) Room 1 – Room 8 (15.00-15.15) Room 1 – Room 8 (15.15-15.30) **Break (30 minutes)** Room 1 – Room 8 (16.00-16.15) Room 1 – Room 8 (16.15-16.30) Room 1 – Room 8 (16.30-16.45) Room 1 – Room 8 (16.45-17.00) Room 1 – Room 8 (17.00-17.15) Room 1 – Room 8 (17.15-17.30)	**Laptop, file**

No	Activity	Time	Duration	PIC	Necessity
				Break (30 minutes)	
15	Announcement best paper/presenter and reviewer Closing speech	18.00 – 18.30	30 minutes	Room 1	Laptop, internet

PARALLEL SESSION TIMETABLE ICVEE

Saturday, October 3, 2020

Room 1

Moderator **1** **IGP Asto Buditjahjanto**

2 **Lilik Anifah**

No	Paper ID	Paper Title	Time (GMT +7)
1	266	Differences Between Students from Senior High School and Vocational School in the Learning Outcomes of Electrical Engineering Students	14.30-14.45
2	270	absent	
3	276	Combining the Unsupervised Discretization Method and the Statistical Machine Learning for the Modeling of the Students' Performance	15.00-15.15
4	294	The effect of changing the type of lamp, lighting power and adding light points to the strength of the lighting in the Classroom and Reading Room of the Postgraduate Program at the Bung Hatta Building, Jakarta State University	15.15-15.30
	BREAK		14.45-15.15
5	352	absent	16.00-16.15
6	362	absent	16.15-16.30
7	363	Google Classroom Effectiveness and Efficiency as Alternative Online Learning Media to Overcome Physical Distancing in Lectures as a result of the Covid-19 pandemic: Student Perspectives	16.30-16.45
8	367	Effectiveness of Mobile Learning Implementation in Increasing Student Competence and Preventing the Spread and Impact of COVID-19	16.45-17.00
9	368	The Effect of Participation in Scientific Research and Conference on Vocational Teachers' Competencies	17.00-17.15
10	412	Evaluation of Indonesian Technical and Vocational Education in Addressing the Gap in Job Skills Required by Industry	17.15-17.30

Room 2

Moderator **1** **Hapsari P A Tjahyaningtijas**

2

No	Paper ID	Paper Title	Time (GMT +7)
1	413	Semantic Web Ontology for Vocational Education Self-Evaluation System	14.30-14.45
2	416	The impact of The COVID-19 Pandemic in Indonesia (Face to face versus Online Learning)	14.45-15.00
3	425	absent	15.00-15.15
4	459	DESIGN OF COMPETENCY TEST MODEL FOR ELECTRICAL INSTALLATION AUTOMATION BASED ON PROJECT LEARNING FOR ELECTRICAL ENGINEERING STUDENTS	15.15-15.30
		BREAK	14.45-15.15
5	474	EFFECTIVENESS THE USE OF INTERACTIVE MULTIMEDIA LEARNING MEDIA IN FACIAL SKIN CARE COURSES	16.00-16.15
6	476	The Effect of the Android based Mobile-Learning Models on Student Learning Outcomes in Research Methodology Courses in the Cosmetology and Beauty Department	16.15-16.30
7	489	The Marketing of Teaching Factory Product Through Online E-Commerce at Fashion Design Vocational High Schools	16.30-16.45
8	507	absent	16.45-17.00
9	330	FACTOR ANALYSIS THAT INFLUENCES CPL/PILOT LICENSE COMMERCIAL PHASE TECHNICAL KNOWLEDGE OF CADETS OF OFFICIAL AVIATION SCHOOL VOCATIONAL EDUCATION	17.00-17.15
10	347	Measurement Model of Employability Skills of Vocational High School Student in East Java Using Structural Equation Model (SEM)	17.15-17.30

Room 3

Moderator	1	Naim Rochmawati
	2	Yeni Anistyasari

No	Paper ID	Paper Title	Time (GMT +7)
1	231	Learning Solutions for Multi Interaction-Based Computer Network Devices with Mobile Augmented Reality (Effectiveness, Interface, and Experience Design)	14.30-14.45
2	236	The Concept of Using TOLSYASUPI-EduMed in Basic Programming Learning with Problem-Posing Interaction Flow	14.45-15.00
3	238	E-Voting on Blockchain using Solidity Language	15.00-15.15
4	303	Risk Analysis of Cloud Computing in the Logistics Process	15.15-15.30
	BREAK		14.45-15.15
5	382	absent	16.00-16.15
6	433	Deep Learning Implementation of Facemask and Physical Distancing Detection with Alarm Systems	16.15-16.30
7	430	Covid Symptom Severity Using Decision Tree	16.30-16.45
8	462	An Enhanced Cryptographic Algorithm in Securing Healthcare Medical Records	16.45-17.00
9	538	Detecting SQL Injection On Web Application Using Deep Learning Techniques: A Systematic Literature Review	17.00-17.15
10	554	Integration of FAHP and COPRAS Method for New Student Admission Decision Making	17.15-17.30

Room 4

Moderator	1	Salamun Rohman Nudin
	2	Ricky Eka Putra

No	Paper ID	Paper Title	Time (GMT +7)
1	568	Non-Proliferative Diabetic Retinopathy Classification Based on Hard Exudates Using Combination of FRCNN, Morphology, and ANFIS	14.30-14.45
2	406	A New Adaptive Online Learning using Computational Intelligence	14.45-15.00
3	420	The design and implementation of web crawler distributed news domain detection system	15.00-15.15
4	427	High Availability in Software-Defined Networking using Cluster Controller: A Simulation Approach	15.15-15.30
	BREAK		14.45-15.15
5	435	Pneumonia and COVID-19 Detection using Convolutional Neural Networks	16.00-16.15
6	354	What's in a Caption?: Leveraging Caption Pattern for Predicting the Popularity of Social Media Posts	16.15-16.30
7	372	Fractional Gradient Descent Optimizer for Linear Classifier Support Vector Machine	16.30-16.45
8	411	The Identification of the Apples (Malus Sylvestris) Skin Wax Coating Using the Edge Detection Method	16.45-17.00
9	453	Key Rate Enhancement by Using the Interval Approach in Symmetric Key Extraction Mechanism	17.00-17.15
10	484	EnORS: An Enhanced Object Relationship Schema	17.15-17.30
11	450	Development of Mapping Area Software for Dismissal people affected by Covid 19	17.3--17.45

Room 5

Moderator **1** **Reza Rahmadian**

2 **Rifqi Firmansyah**

No	Paper ID	Paper Title	Time (GMT +7)
1	298	Validation of Voice Recognition in Various Google Voice Languages using Voice Recognition Module V3 Based on Microcontroller	14.30-14.45
2	322	Texture Analysis of Knee Osteoarthritis Using Contrast Limited Adaptive Histogram Based Gray Level Co-occurrent Matrix	14.45-15.00
3	334	Design of Model Predictive Control for Stability of Two Stage Inverted Pendulum	15.00-15.15
4	358	Hydrothermal Growth Temperature Dependence of Nanostructured Nickel Oxide Transparency	15.15-15.30
		BREAK	14.45-15.15
5	359	Designing Automatic Dispensers for the Blind People based on Arduino Mega using DS18B20 Temperature Sensor	16.00-16.15
6	365	Effects of Precursor Concentration on the Transparency of Hydrothermally Grown Zinc Oxide	16.15-16.30
7	525	A Dual UPQC to Mitigate Sag/Swell, Interruption, and Harmonics on Three Phase Low Voltage Distribution System	16.30-16.45
8	370	Design and Implementation of IoT System for Aeroponic Chamber Temperature Monitoring	16.45-17.00
9	397	Autonomous Robotics in Agriculture: A Review	17.00-17.15
10	401	Design of Fire Detection Equipment Due to the Arc-Fault Series on Low Voltage Networks Based on Internet of Things (IoT)	17.15-17.30

Room 6

Moderator	**1**	**Arif Widodo**
	2	**Unit Three K**

No	Paper ID	Paper Title	Time (GMT +7)
1	466	A Hybrid Classification Based on Machine Learning Classifiers to Predict Smart Indonesia Program	14.30-14.45
2	272	Optimization of Water Level Control Systems Using ANFIS and Fuzzy-PID Model	14.45-15.00
3	384	[Design And Development Of Student Absention Application Prototype Using Android-Based Flutter: A Case Study In Electro Engineering Department Of Mataram University	15.00-15.15
4	480	SIMULATION AND PERFORMANCE EVALUATION OF FIBER OPTIC SENSOR FOR DETECTION OF SALINITY IN PRAWN POND APPLICATION	15.15-15.30
	BREAK		14.45-15.15
5	488	MICROCONTROLLER AND WIRELESS COMMUNICATION BASED SMART LABORATORY BOX SYSTEM IMPLEMENTATION	16.00-16.15
6	491	Management of Empty Parking Spot Based On Computer Vision	16.15-16.30
7	369	Performance Evaluation of ESP8266 for Wireless Nurse Call System	16.30-16.45
8	374	A current mode ACG base on Sub-threshold MOS Translinear Principle	16.45-17.00
9	424	Combination of Fuzzy C-Means and Simple Additive Weighting Using Partition Coefficient Index	17.00-17.15
10	485	A Neuro-Fuzzy Approach for Cacao Bean Grading Classification Process	17.15-17.30

Room 7

Moderator **1** **Mahendra Widyartono**

2 **Widi Aribowo**

No	Paper ID	Paper Title	Time (GMT +7)
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2	293	SETTING COORDINATION RELAY PROTECTION ON MULTYLOOP MODEL DISTRIBUTION ELECTRICAL POWER SYSTEM SISTEM USING FIREFLY ALGORITHM	14.45-15.00
3	300	HYBRID MODEL FOR THE NEXT HOURLY ELECTRICITY LOAD DEMAND FORECASTING BASED ON CLUSTERING AND WEATHER DATA	15.00-15.15
4	402	Partial Shading Effect on I-V Characteristic and Maximum Power of a Photovoltaic Array	15.15-15.30
	BREAK		14.45-15.15
5	428	Effect of Combination Fractional Slot Number and Slotting Tecnique on the Cogging Torque in Permanent Magnet Machines	16.00-16.15
6	267	absent	16.15-16.30
7	361	Research on the Influencing Factors of Industrial Designers' Potential Traits on Career Planning	16.30-16.45
8	442	DESIGN OF AERIAL ROBOT AS TEACHING MEDIA WITH EDUCATIONAL ROBOTIC BASED LEARNING SYSTEM	16.45-17.00
9	454	The Roles of Information Technology Knowledge and Online Learning in Learning Environment Changes at Vocational Education System	17.00-17.15
10			17.15-17.30

Room 8

Moderator **1** **Eppy Yundra**

2 **Nurhayati**

No	Paper ID	Paper Title	Time (GMT +7)
1	280	Motion Sensing for Wireless Body Area Networks Based on Android Using Wi-Fi Direct Transmission	14.30-14.45
2	316	Impact of Nonlinear Distortion with the Rapp Model on the GFDM System	14.45-15.00
3	319	The New Intelligent Wireless Sensor Network using Artificial Intelligence for Building Fire Disasters	15.00-15.15
4	327	A Vivaldi Antenna Palm Tree Class with Koch Square Fractal Slot Edge for Near-Field Microwave Biomedical Imaging Applications	15.15-15.30
	BREAK		14.45-15.15
5	336	Decision Support System Cattle Weight Prediction using Artificial Selected Weighting Method	16.00-16.15
6	349	Design of X-Band Microstrip Antenna for Circularly Polarized Synthetic Aperture Radar (CP-SAR) System	16.15-16.30
7	371	Design of Horizontal Polarization Microstrip Patch Antenna with Bandwidth Enhancement at C-band Frequency	16.30-16.45
8	376	Comparison Study of Hilbert Sierpinski and Koch Fractal on Coplanar Vivaldi Antenna for L and S band application	16.45-17.00
9	410	Design of a Microstrip Line Quad-band Bandpass Filter based on Fibonacci geometric sequence	17.00-17.15
10	461	Potentials of metasurface technology on antennas and propagation	17.15-17.30

Table of Contents

Tuning of Power System Stabilizer Using Cascade Forward Backpropagation

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***Abstract*—The Overshoot and time settling of the electromechanical are a serious problem for tuning PSS. Cascade Forward Backpropagation (CFBNN) has a topology similar to Feed Forward Back Propagation. It is using Backpropagation to updating weights. The Network has the advantage that it is a bypass. That connects the input layer that passes through the hidden layer. The networks are dynamic. The research was implemented to oppose conventional PSS (C-PSS) and Cascade Forward Backpropagation Neural Networks (CFBNN-PSS). The focus of the research was on rotor angle and angular frequency. The result of proposed CFBNN has better performance to reduce of overshoot angular frequency and rotor angle. The CFBNN PSS can reduce overshoot of angular frequency until 90.7% with faster time-settling**

Keywords— PSS, Artificial Intelligence, Cascade Forward Backpropagation, Neural Network, Heffron Phillips

I. INTRODUCTION

Electric power systems are operated in a steady-state frequently interference. The disorder was caused by switching operations, detaching plants, shorting circuits, loading suddenly, etc. It can interfere with the harmony of the system. It would influence the generator stability and can result in the synchronization system decreases.

Electric power systems are grouped into three groups namely generating systems, transmission systems and distribution systems. The generation system is a place convert mechanical energy into electrical energy.

Small load changes will affect the harmony of the electrical system. The ability of the system to respond to the system to these changes is called the dynamic stability of the electric power system. Changes in generator rotor speed and generator terminal voltage are sometimes influenced by small changes in load.The speed of the generator rotor will be swinging around the synchronous speed and the generator voltage around the nominal value. A generator is said to be stable if the rotor speed returns to synchronous speed and convergent voltage to certain value around the nominal value after the disturbance (change of load),

The C-PSS (conventional PSS) is commonly planed using a linear model of the system for a fixed employing point [1]. Power System Stabilizers (PSS) are providing a damping torque with the goal to minimize oscillations generated by external disturbance. The key to reducing low oscillations in the generator is tuning of the PSS [2-3].

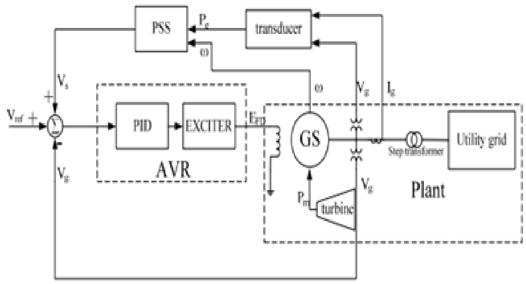

Fig. 1. System structure[10]

Classical control using linear modeling with parameters remains a popular concept in PSS. Obstacles that often arise in electrical systems are loads that are non-linear and change every time

However, because of the nonlinearity the system as well as parameter uncertainty, conventional PSS cannot suitably to minimize low-frequency swing and ineffective to supply a solid performance. Some researchers have developed some of the latest methods in PSS design. Berbagai teknik dihadirkan yaitu Particle Swarm Optimization [4], Cuckoo Search Algorithm [5], Fuzzy logic [6], Artificial bee colony [7], dan cultural algoritma [8].

Conventional PSS design cannot guarantee the harmony of the electrical system due to the influence of increasingly complex system dynamics. Therefore, the design of high performance PSS is needed with the latest method. This study discusses the PSS design using the CFBNN algorithm. The Power System Stabilizer using CFBNN is employed in a single-machine system. CFBNN-PSS results will be compared with conventional PSS and Elman-recurrent neural networks. The focus of this research is the rotor angle and angular frequency of the generator output.

II. POWER SYSTEM STABILIZER

Electromechanical oscillation and inter-area oscillation control which is popularly used is the power system stabilizer (PSS) [9]. The high gain from AVR, HVDC converter or Static Var Compensator (SVC) can cause low-frequency oscillations with negative attenuation. It is a dynamic stability problem.

AVR negative attenuation is compensated using PSS. The principal purpose of the PSS is to expand the stability limit with controlling generator excitation by providing rotor

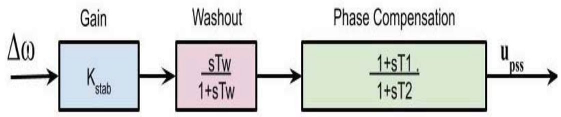

Fig. 2. The Block Diagram of PSS

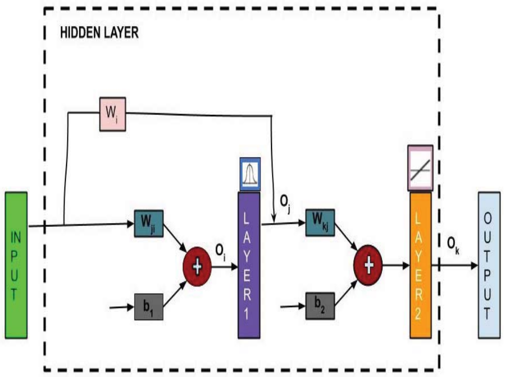

Fig. 3. Cascade Forward Backpropagation Neural Network Architeture.

damping, especially on interconnected machines. to produce damping of the torque component, the pss must produce a signal that is used to regulate the excitation of the generator.

PSS has three primary components. Gain is the amount of attenuation generated by the PSS and can be adjusted to the maximum state. The washout has a function as a high pass filter that is used to reduce oscillations. Phase compensation which serves to perform lagging phases.

III. Cascade Forward Backpropagation

The concept of cascade back-propagation (CFB) is to combine backpropagation and cascade-correlation algorithms [11]. This network is formed from input, hidden, and output [12]. The conceptual of CFB is to accelerate learning on neural networks. CFB presented by Scott Fahlman at Carnegie Mellon in 1990.

Cascade forward backpropagation and feed-forward architectures are similar [13]. Cascade forward backpropagation has a dynamic character[14]. The weighting connections of Cascade Forward Backpropagation are at the input and the next layer. In the hidden layer, it has weights coming from the input. The second layer and so on have weights derived from the input and the previous layer. The bias is added in all layers. In the end, it is namely output layer [15]. This will be affected by increasing the weight of the network following the neurons in the input layer.

TABLE I. Symbol of CFBNN

Symbol	Parameter
W_{ji}	Weight of input
W_{kj}	Weight input for hidden layer
p^1	Input
O_j	Output of Hidden Layer (layer 1)
O_k	Network Output
W_{ki}	Weight of hidden layer
b_i	Bias

The cascade forward backpropagation model is employing backpropagation algorithms to improve weights. The sigmoid and pure linear transfer function threshold function is used to reach the peak condition. The deflection between target and output results in an error. It is multiplied by the output derivative of the activation function. Weights will be stored and become candidates in hidden units on the network. The equation Cascade Forward Backpropagation architecture from figure 3.

Layer 1

$$O_i(t) = \sum_{i=1}^{j} W_{ji} p^1 + b_1 \quad (1)$$

$$O_j(t) = \int O_i(t) \quad (2)$$

Layer 2

$$O_k(t) = \int (b_2 + \sum_{j=1}^{k} W_j^o . \int O_i(t) . \sum_{i=1}^{j} f^1 W_i p^1) \quad (3)$$

One of the methods to measure the difference between the output value and the target is Mean squared error (MSE). The math formula is as follows:

$$MSE = \frac{1}{n} \sum_{k=1}^{n} \left(x_k(t) - O_k(t) \right)^2 \quad (4)$$

The CFB recognize wave the output and attempt to restrain the overshoot. If it has appeared error , the wave is brought back to NN for the learning process again. It has one input Δω. Δω is the output system for input CFBNN. It is for training The Formula is :

$$Xi(t) = [\Delta\omega] \quad (5)$$

Where ω is the angular velocity in rad/s. CFBNN-PSS has installed to the system after the mapping process finished

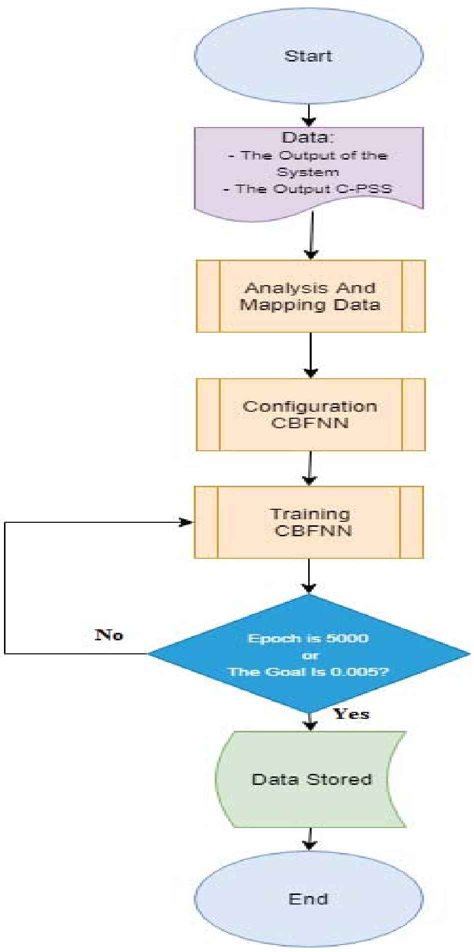

Fig. 4. Flowchart Of Design CFBNN-PSS

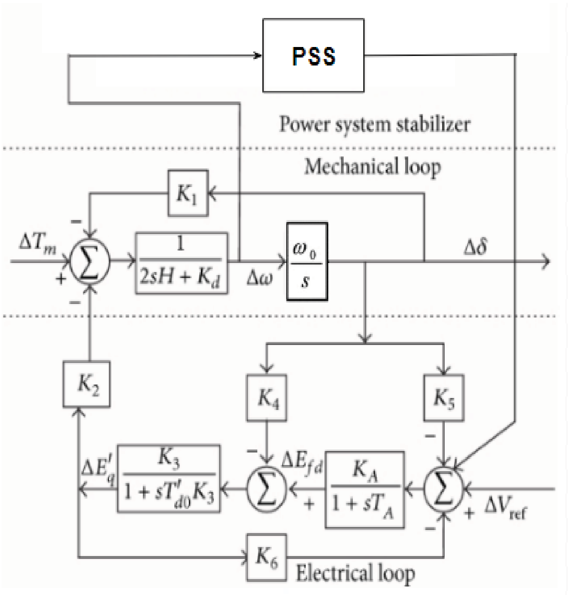

Fig. 5. Single Machine Block Diagram.

TABEL II. CASCADE FORWARD BACKPROPAGATION PARAMETERS

Syntax	Parameter
Hidden Layer	2
Epoch	5000
LR	0.1
MC	0.5

TABLE II. SYMBOL LIST OF ELECTRICAL LOOP

Parameter	Function
$K_2 - K_6$	Heffron-Phillips model coefficients
K_A	DC gain of the AVR
T_A	Time constant of the AVR
ΔV_{ref}	Reference voltage of the AVR
ΔE_{fd}	Field winding voltage that from AVR output

TABEL IV. SYMBOL LIST OF MECHANICAL LOOP

Parameter	Function
K_1	Heffron-Phillips model coefficients
H	Shaft inertia constant
K_D	Damping constant
T_m	Mechanical torque from turbine
ω	Rotor angular speed
δ	Rotor angle

IV. PROPOSED CFBNN FOR TUNING PSS

The Flowchart of CFBNN training can be seen in Figure 4. The first step is making system modeling. The Data is taken from the system output which is angular frequency. The data obtained is analyzed and mapped.Then, The CFBNN training and configuration is conducted. The CFBNN training will stop if the epoch reaches 5000 or the goal crosses 0.005.

V. RESULTS AND DISCUSSION

The generator model using Heffron-Philips can be visible in Figure 5. The Heffron-Philips model consists of Mechanical loop, and electrical loop. The detail of variables can be seen Table 3. The training data to decrease overshoot is the output system with variable speed including the interference.

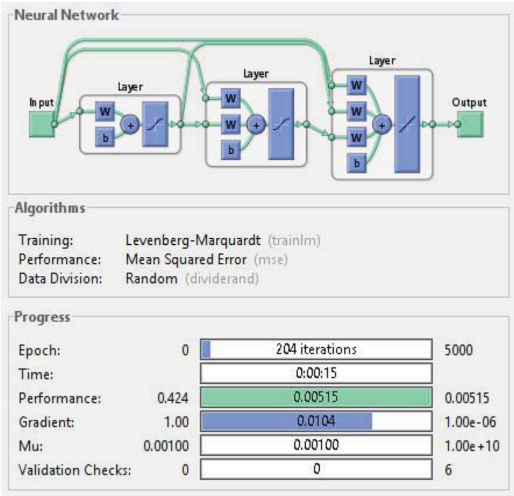

Fig. 6. Training CFBNN

The results of the CFBNN training can be seen in Figure

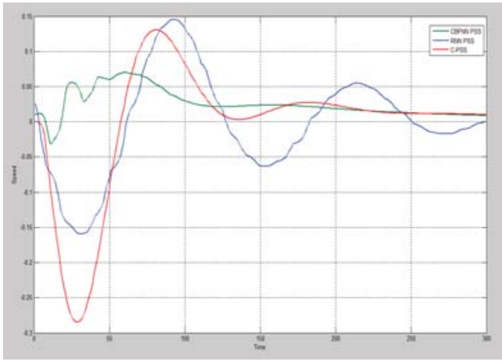

Fig. 7. Angular Frequency Comparation

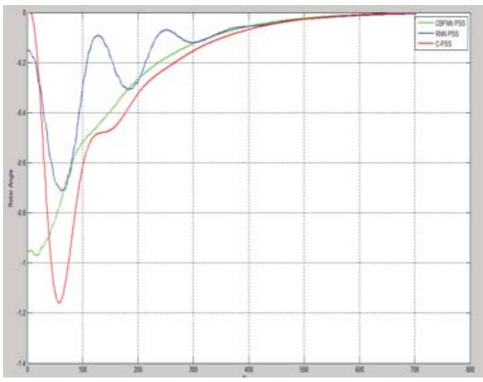

Fig. 8. Rotor Angle Comparation

6. The CFBNN is takes 15 seconds for training. the algorithm used by levenberg-marquardt. the required iteration is 204 of 5000. The goal limit is fulfilled which is frequency and rotor angle with injected 1 p.u load.

Figure 7 and Figure 8 are response from angular frequency and rotor angle with injected 1 p.u load. In Table 5, CFBNN PSS can reduce 0.25822 p.u the surprises wave of the angular frequency from 0.2844 p.u to 0.02618 p.u.

TABLE IV. ANGULAR FREQUENCY OVERSHOOT

Type PSS	**Overshoot (p.u)**	**Time Overshoot (ms)**
Conventional PSS	1.158	59
RNN PSS	0.71	63
CFBNN PSS	0.97	18

TABLE III. ROTOR ANGLE OVERSHOOT

Type PSS	**Over shoot (p.u)**	**Time Over shoot (ms)**	**Time Settling (ms)**
Conventional	0.2844	28	600
RNN PSS	0.1587	33	588
CFBNN PSS	0.02618	13	567

CFBNN can cut down the exceed wave of rotor angle to 0.97 pu. It can be seen in Table 6.0.00515.

VI. CONCLUSIONS

The CFBNN design in this study has 2 hidden layers with sigmoid training. Training of The output is using linear transfer function. The CFBNN PSS is installed in Single Machine. It is competent to fix the performance of the plant. The CFBNN is showed that the CFBNN PSS can present preferably opposed C-PSS. It has shown that PSS based on CFBNN is preferable for PSS under disturbances. From the test, it was found that the proposed method had a better ability to suppress swings. The CFBNN-PSS can turn down the peak of angular frequency until 90.7%. The CFBNN method has faster time-settling at angular frequency. It is 33 seconds faster than C-PSS. On other hand, RNN-PSS is only capable of 22 seconds compared to C-PSS. The CFBNN method has faster time-settling compared to RNN. It is about 11 second.

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