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Dear Colleagues,

On behalf of the editorial board of International Journal of Engineering Technologies (IJET), I would like to share our happiness to publish the fourth issue of IJET. My special thanks are for members of editorial board, editorial team, referees, authors and other technical staff.

Please find the fourth issue of International Journal of Engineering Technologies at http://dergipark.ulakbim.gov.tr/ijet. We invite you to review the Table of Contents by visiting our web site and review articles and items of interest. IJET will continue to publish high level scientific research papers in the field of Engineering Technologies as an international peer-reviewed scientific and academic journal of Istanbul Gelisim University.

Thanks for your continuing interest in our work,

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Use of Solar Energy in Electric Vehicles

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Abstract- In today's World, energy has a crucial importance for all countries. The countries search for both new energy resources and how they can use them. Energy resource is an important problem in our country, too. It is the sign of how it is important that we are mostly foreign dependent on energy. The most important energy problem is energy efficiency. When changing and developing automotive industry is handled, an important part of energy consumption consists of automobiles. So, it is clear that even small scale efficiency studies can save energy when thought in general basis (all automobiles). Practical solutions about efficiency increase in present vehicles, electrical efficiency and structure of vehicles working with energy taken from the sun is analyzed in our study.

Keywords- Hybrid vehicle; efficiency; solar car; electric vehicles; photovoltaic

1. Introduction

The effects of global warming and running out of energy resources with rapid growing energy in the World make the World countries seek solutions. So, energy has become main agenda for the World and it will be so. While the countries work for new energy resources, they also emphasize their efficient use. While other countries have some problems, it has become an important problem for our country if it is thought that we are mostly foreign dependent and the energy demand is a problem, too. Our country especially works on the policies about energy efficiency besides energy resource search. So, the most important thing in our country is energy efficiency. An important part of energy consumption consists of increasing number of vehicles. So, even very little energy save accounts for huge amounts of save when all vehicles are considered. The movements of the vehicles are accomplished with petrol consumption which is an fossil fuel resource today. The researchers seek different energy resources for long years because fossil fuel resources are limited, exhaustible and results in environmental pollution. In this concept, the thought of electrical vehicles is present for long years.

2. Energy Save by Making Use of Solar Energy

Many studies on electrical vehicles running by transforming solar energy to electrical energy have been conducted for many years. The infrastructure situations and high cost of electrical vehicles make it less possible to use electrical vehicles although electrical vehicles are important for researchers because of the increase in the cost of energy and the effects of global warming. Because of this and other similar reasons, vehicles running with electricity are widely used. So, the researchers generally have tendency towards systems which can save energy.

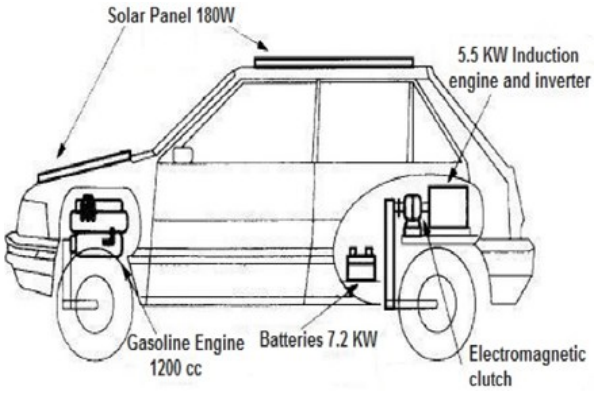

Fig. 1. Structural diagram of hybrid vehicle

The hybrid car shown in Figure 1 has two power sources which are hybrid electrical motor and petrol motor. Two power sources change automatically according to their drive values which can be set. For example; when the vehicle which can run with electrical in low speed reaches high speed, it can switch to petrol motor. The hybrid vehicle shown in Figure 1 is redesigned and a petrol with 1200cc, induction motor with 5.5 kW, a battery with 288 V and 25 Ah and a photovoltaic panels are added. This hybrid vehicle reaches 1200 kg by increasing 350 kg with hybrid vehicle load. There is a need for photovoltaic panel which has an average power of 1.6 kW to provide total electrical energy

from photovoltaic panels. The experimental results stated in Figure 2 show that travel distance with 1.1 m/ s² speed with hybrid vehicle electrical motor which can provide energy save occurring smoothly between petrol motor and electricity motor becomes 1.74 km. When it is thought that battery capacities have the power of 7.2 kWh, the travel distance of the car occurring with electricity motor reaches 40 km [1].

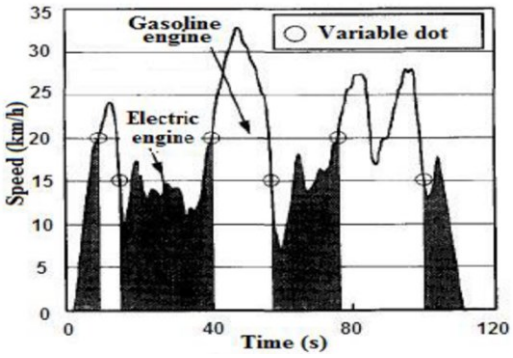

Fig. 2. Movement performance of hybrid car

A great amount of energy can be saved by using hybrid cars instead of the traditional cars running with petrol. Also, energy saving can be possible with a similar approach. The air conditioner of car can run without using petrol by placing a photovoltaic panel on it. Although it is a photovoltaic panel with low power because of the limited space on the car , the energy required for air conditioning system and indicators can be saved. Solar cars run by transforming solar energy into electrical energy. Solar vehicle one of the different types of transportation is a vehicle running with electricity consisting of rechargeable solar batteries and accumulators [2, 3]. The space for solar batteries for a solar vehicle is less than 8 m². So, solar vehicle which will be produced must be in low weight and energy efficient [1]. The control system in solar vehicles is very important. The follow-up and feedback control information of vehicles running with solar energy should be under constant follow-up. Information about voltage, current, power and heat of motor, accumulator and photovoltaic panels in the vehicles should be measured. The measured data should be handled with a feedback control system and evaluated by analysing them.

3. Electrical Structure of Solar Vehicles

3.1. Figure Properties

One of the most important equipment of solar vehicles is electricity motor. In order for electrical motor to have good performance, a motor with optimal power and efficiency should be chosen. Energy efficient motors should be analyzed. While the loss of electricity motor is tried to be minimized with the help of choosing efficient motor, a good couple should be provided with mechanical system motor which will be attached to motor at the same time that mechanical loss can be minimized. The motors in these vehicles are in 10-12 BG. The motor power comes from storage batteries. These motors are in the same structure and working system as in the electricity motors. The efficiency of electricity motors is quite better than that of internal combustion (max 96%). The motor in 10 BG is used in Halophile Pi developed by New Generation Motors. The efficiency of the motor is 90%. A sample vehicle motor with solar battery is shown in Figure 3 [1].

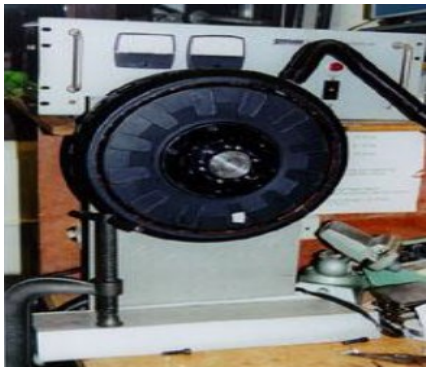

Fig. 3. Solar battery operated vehicle [6]

The photovoltaic panels transforming solar energy into electric energy store the electricity they produce in batteries. The stored energy make the vehicle's car move [4].

$$P = \left[V - E_a\right] i_a \text{ or } P = \left[V - E_a\right]^2 / R_a \quad (1)$$

The torch of the load is zero when there is no extra load and friction in the and so the output power is zero, too. The input power is low and electromotor back power is nearly equal to the input voltage. Only the power taken form battery consists loss torch [4].

$$P_{loss} = T_{loss}\Omega \quad (2)$$

When engine moves with torc input power becomes very high.

$$P = V^2 / R_a \quad (3)$$

But output power is zero as speed is zero. The power taken when the efficiency of the motor is defined as the amount of mechanical power can be found by dividing electrical input power [4].

$$Efficiency = \frac{Power\ Output}{Power\ Input} \quad (4)$$

Efficiency changes in contrast to load torch. In Figure 4, changing efficiency of Iskra shunt motor with torch [1].

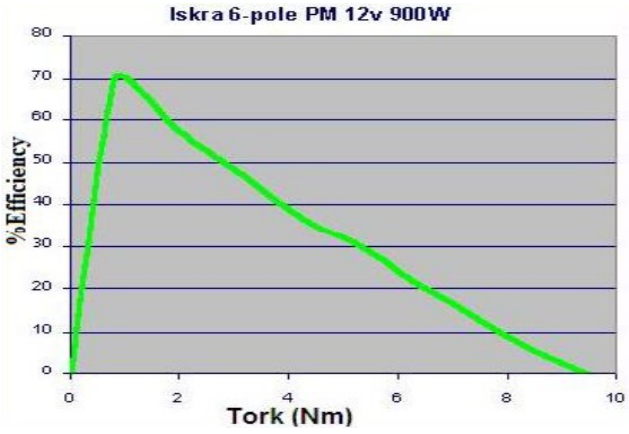

Fig. 4. Graphic of iskra shunt efficiency–torch [1]

3.2. Battery

Drive battery is the main power source of a vehicle. It is required to meet surplus power need and store surplus energy. The battery group is formed by connecting batteries parallel or series for appropriate tension and capacity. Lead acid accumulators are not preferred because of their low capacity for unit mass and low charge and discharge efficiency in solar vehicles. The developed battery systems such as nickel metal hydride, lithium ion, lithium polymer are used. Charging control cycle which will help the batteries to charge rapidly and securely should be used. The procedures used in battery choice [4];

- Firstly types of batteries are researched.
- The voltage with which the system will work is determined.
- In this voltage, cell combination which will provide proximate values to limit capacity is formed according to the accumulator types and models.
- The ones which meet the highest current demand are chosen.
- Total weight of these combinations is calculated.
- Total cost of chosen combinations is calculated.
- Cycle production/supply for accumulator types which can be used for secure electronic cycle and its cost are added to the calculation.
- Maximum amount for all battery groups in budget is determined.
- Light combination with the highest capacity which is not over the budget is chosen.
- The suitability/methods of montage and connection of the type chosen.
- The things such as appropriateness to race rules and power (electricity) system, mechanical durability are checked for the last time and it is ordered.

3.3. Solar Panel

One of the important equipment of the solar electricity cars is photovoltaic battery. The photovoltaic batteries produce electricity current by using photon energy in the sunlight with the help of movements of electrons with semiconductor technology [4]. The photovoltaic batteries are used in many fields such as electricity power stations, satellite communication, etc. We examine the photovoltaic batteries in solar cars without talking about detailed information about photovoltaic batteries. The widely used photovoltaic batteries are silicon and gallium arsenide solar batteries. While the satellites use gallium arsenide, silicon ones are usually used in the earth. Silicon batteries are used in the cars which have storage features. Numerous cells come together one by one to constitute solar panel. These panels can give power between 12 and 1000 voltage and endless watt depending on the motor used. The intensity of sunlight, clouds and the temperature effects the power produced by the panels. Any solar cell can be used in other type of solar cars. Because of this flexibility, many solar cars team use gallium arsenide solar cells used in space. These are usually more expensive and smaller than the traditional batteries. But they are more efficient. Power difference between than may reach to 1000 watt while the cost is 10 times more [5]. The solar batteries used in vehicles are usually 14%. The solar battery is brazed and cleaned carefully one by one before using in car. Another preparation is putting solar batteries in composite panels (usually 8-12 pcs). The weight of the panels is usually low. The solar batteries are sticked to the panels by a special vacuum technique to increase security. The panel is both protected against external factors and becomes waterproof with the help of it. Panels are designed to be changed easily in case of a breakdown. (only in a few minutes). Later, electronic circuit in the batteries is attached to the whole panel and a power output of 800-960 W can be accomplished [1].

3.4. MPPT (Maximum Power Point Follow-up)

In Figure 5, I-V and P-V graphics of temperature changes under stable lightening.

[1].

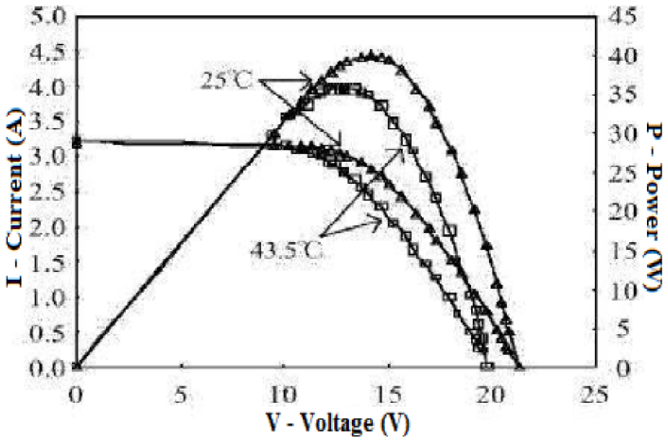

Fig. 5. I-V and P-V characteristics of solar battery [6]

Approximate statements of I – V characteristics shown in Figure 5;

$$Y = 1 - X^n \tag{5}$$

Power;

$$P = V_{OC} X . I_{SC} Y = V_{OC} I_{SC} . X(1 - X^n) \tag{6}$$

V_{OC} is open circuit voltage. I_{SC} is short circuit current. Power is maximum in the summit. In the summit $Pd(t) = 0$. When X is solved maximum, maximum $X_{p\max}$ operation electricity power point is max.

$$X_{p\max} = \{1/(n+1)\}^{1/n} \tag{7}$$

I-V characteristic changes because of heat and temperature if n parameter is given in the maximum power point stated in equation 7. The effects of these should be taken into consideration in n parameter change. N parameter stated in equation 6 goes on like this [6];

$$n = \frac{\log(1 - \frac{P}{V_{OC} I_{SC} X})}{\log X} \quad (8)$$

The equation stated in Equality 8 is very complicated. A clear statement of the equation is given in Figure 6 by calculating the values measured from the equation. Figure 6 shows n values calculated according to lightening and temperature.

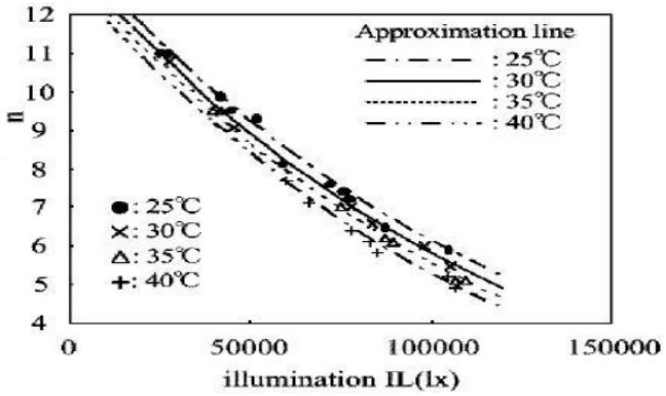

Fig. 6. Change of the parameters with measured values [6]

3.5. Advanced Control Systems

- Momentum control prevents unnecessary power use by keeping momentum in certain values in vehicle's take-off and acceleration. The system controls the change of time according to time and sends warning to decrease power in case it is over certain level.
- The cruise control system immobilizes and changes its speed or energy use automatically in desired levels in phases during its course. Holding wheel and watching whether the system works appropriately or not by the pilot is enough as long as the system runs. It is a system which analyzes data such as speed, position (GPS or the way), used/remaining energy, solar energy and decides and arranges vehicle according to these. It requires detailed energy calculations.

4. Conclusions

When energy consumption is thought, automobiles have an important share. We examine electrical efficiency in cars by studying on new generation electricity cars. Additionally, we try to determine a way for possible new designs for new cars. As the infrastructure of cars running by converting the energy taken from sun into electricity cannot reach desired levels, it is quiet costly today. Saving which can be done with small changes in present cars should not be ignored. Practical approaches should be developed by making detailed researches on these approaches.

When energy consumption is thought, automobiles have an important share. We examine electrical efficiency in cars by studying on new generation electricity cars. Additionally, we try to determine a way for possible new designs for new cars. As the infrastructure of cars running by converting the energy taken from sun into electricity cannot reach desired levels, it is quiet costly today. Saving which can be done with small changes in present cars should not be ignored. Practical approaches should be developed by making detailed researches on these approaches.

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Contingency Analysis of Ethiopia's 230 kV Transmission Network

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Abstract - Transmission line congestion is any one of the failures that leads the overall transmission network to be either in overloaded or underloaded condition. Loading effects of the entire network may lead the system to cascaded outage or total blackout. The study concentrated on the contingency analysis of Ethiopia's 230KV transmission network a case of Sebeta to Kaliti transmission line. The outage of this line causes overloading on Gefersa to Kaliti transmission line and makes the system not to be secure and reliable; further cascaded outage will lead the system to the total blackout. The analysis has been conducted by considering four scenarios such as a normal state, single line outage, cascaded line outage and inserting Distributed Static Series Compensator (DSSC) into the overloaded line. As a result, the system became reliable and secure by inserting the device in the most sensitive line of the network.

Keywords - Contingency analysis, D-FACTS devices, transmission network.

1. Introduction

Contingency is a failure of any power system equipment from the network due to some emergency situations [1]. Transmission line congestion is any one of the failures that leads the overall transmission network to be either in overloaded or underloaded state. Contingency analysis enables the system to be operated effectively. The major problems that occur in power system can cause serious damage within a short time if the operator could not take an immediate corrective action.

Ethiopia electric power transmission network is more complicated due to the centralized grid interconnection system. Therefore, a loss of one transmission line from the network will gradually disturb the rest of the system. The network needs latest autonomous control and protective mechanisms on the selected transmission line to make the system secure.

Power flow control is the ability to control the distribution of power flow among transmission lines with respect to transmission line reactance. The power flow control through the transmission lines enable to use the existing power system efficiently. Especially, maintaining reliable and secure electric power is required during the system component congestion, typically transmission line outage. Varying transmission line reactance can be achieved with the help of electronic devices, capable of injecting variable reactance (inductance or capacitance), depending on the situation.

Distributed Flexible AC Transmission System (D-FACTS) devices are a new technological device used to inject the reactance depending upon the condition. The devices are the best solutions to control power flow through transmission lines in terms of size, cost and efficiency, typically Distributed Static Series Compensator (DSSC), by injecting reactance. İt balances the power flow distribution through the overall network during the line outage; assuring power system reliability and security.

2. D-FACTS Component and Operatıon

D-FACTS devices may facilitate the realization of a comprehensive controllable power system. Large-scale power flow control may finally be achievable [2, 3].

The DSSC system is made up of a large number of modules, each module contains a small rated single phase inverter (10~20 kW), a communication link and a single turn transformer (STT) which can be mechanically clamped on to

or suspended from the transmission line conductor. STT has a transmission conductor as secondary winding and injects the desired voltage in the cable itself [4]. The inverter is self-powered by induction from the line and injects a voltage that is orthogonal to the current. The module can be suspended from the conductor. The STT remains in bypass mode until the inverter is activated and a DC control of the power supply transformer gets excited with the STT secondary winding current. The DSSC schematic diagram is shown in fig. 1 below.

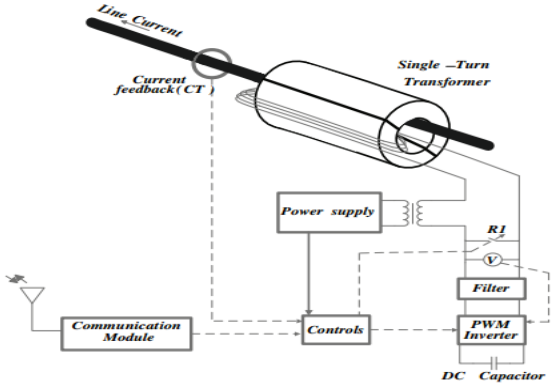


Fig. 1. Schematic diagram of DSSC [5]

Large numbers of DSSCs devices are clamped to conductors of a transmission line to control the line reactance [6]. This feature provides variation in line reactance which results in control of power flow. There is no requirement of phase-ground insulation for DSSC hence has a flexibility of clamping it to any transmission line irrespective of its voltage level [7].

The concept of D-FACTS presents the highest potential to increase power flow and consequently the transfer capacity of a meshed transmission, sub-transmission, and distribution network. In a meshed transmission and distribution network, the power transfer capacity of the system is constricted by the first line that reaches the thermal limit. The inability to effectively power flow control in such a network results in significant under utilization of the overall system.

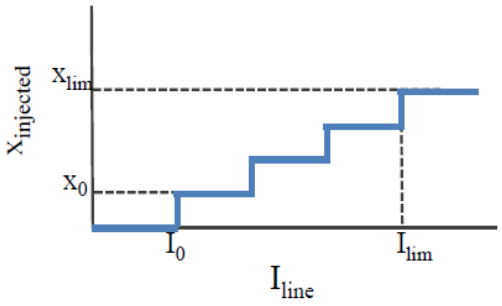


Fig. 2. Operating ranges of D-FACTS [8]

D-FACTS devices offer the ability to improve the transfer capacity and grid utilization by routing power flow from overloaded lines to underutilized parts of the network. Capacitive compensation on underutilized lines would make them more receptive to the inflow of the current, while inductive compensation on overloaded lines would make them less attractive to current flow [9]. In both cases, the whole system is increased by diverting additional power flow from the congested parts of the network to the lines with available capacity using eq. (1) [8, 10] as follows:

$$\text{No. of D} - \text{FACTS} = \frac{(\%\ \text{max.compensation}) * (\text{Tline inductance})}{(\text{Inductance per module})} \quad (1)$$

I_0 = % of rated current (where the percentage is less or equal to 100);

I_{lim} = % of rated current (where the percentage is greater than or equal to 100).

3. Methodology

To achieve the study, the following methods have been used such as data collection and analysis, some reasonable assumptions and case studies have been conducted. The data collected were available in the National Grid Control Center (NGCC) including both numerical system data and single line diagram of Ethiopia's power system network.

The study considered the secondary data that are taken from the Ethiopia Electric Power Corporation (EEPCO) at peak load since 2012 whereas some missing data are filled by data filling software.

In this study, 132KV & 400KV transmission lines have been converted to 230 KV by reducing the thermal limit (A) with the same factor in order to make compatible grid but the MVA limit of the transmission line still remains the same.

A. Transmission Line per unit calculation

$$Z_{pu} = \frac{Z_{actual}}{Z_{base}} \quad (2)$$

Where, $Z_{pu} = R_{pu} + jX_{pu}$

$$Z_{base} = \frac{V_{base}^2}{S_{base}} \quad (3)$$

$$\text{MVA limit} = \sqrt{3} * (V_L * I_{lim}) \quad (4)$$

100 MVA is taken as a base apparent power (S_{base}) for all systems per unit analysis. In addition, base voltages remain the same throughout each line of the network.

Table 1. System input data

Node to Node	R(pu)	X(pu)	B(pu)	MVA limit
Gondar II to B/Dar II	0.000017	0.000061	0.000000306	398
B/Dar II to D/Markos	0.012624	0.086894	0.005267	418
D/Markos to Fincha	0.008054	0.055485	0.000336	418
Fincha to Ghedio	0.008523	0.054260	0.000309	398
Ghedio to GGB I	0.017929	0.101120	0.000616	367
GGB I to GGB II	0.000234	0.000266	0.000014	1217
Gondar II to Alamata	0.060390	0.210050	0.002099	120
B/Dar II to Alamata	0.137508	0.484438	0.042366	355
Alamata to Kaliti	0.084927	0.293071	0.029946	120
Beles to B/Dar II	0.0082	0.12152	0.00120576	1217
Beles to Gefersa	0.001909	0.13007	0.00081162	1217
Wolkite to GGB I	0.000413	0.002809	0.00017644	418
Ghedio to Gefersa	0.004219	0.026859	0.00015307	398

B. Load Input Data Analysis

The study considered substations and distribution centers except the above selected substation as a load, and their data under main load bus bar are summed up to reduce the system complexity. Some of the load is shifted to the appropriate load bus bar and considered as being supplied from it.

Single Line Diagram and Assumptions

As it has been explained above, to come up with an only 230KV grid many assumptions have been done to reduce the whole complex single line diagram into the simple and interesting one. This enforcement was brought due to the limitation of bus bars allowed by software that has been used (only about 13 bus bars are allowed). Accordingly; the 230KV transmission grid is selected even if all 230KVs are not used, since there are about twenty 230KV bus bars. Consequently; shifting of serial bus bars to other bus bar mechanism has been used for the purpose of reducing to 13 bus bars (limited for free access). Except 230KV transmission grid, the whole system has been considered as a load to be supplied from 230KV network. Single line diagram of 230KV transmission network to be studied is shown in fig. 3 below.

DSSC Specification

The DSSC devices to be clamped on the lines should meet the capability of injecting sufficient reactance in accordance with the line fault current. The devices should be specified properly by considering line current flows through a targeted transmission line in both normal and emergency states.

Before the implementation of DSSC, it is obligatory to know the targeted transmission line rated and present flow of currents as well as its impedance. DSSC should be compatible with rated currents of transmission line. Its activation (triggering) current should neither below the expected nor above the rated current. If the triggering current is below the expected, it will start injecting impedance at normal state, but it was no need to do so. Whereas, the transmission line treatment using DSSC devices will be under question when it is above the rated current. Therefore, protective devices will take the action before them depending on the sequence of event execution.

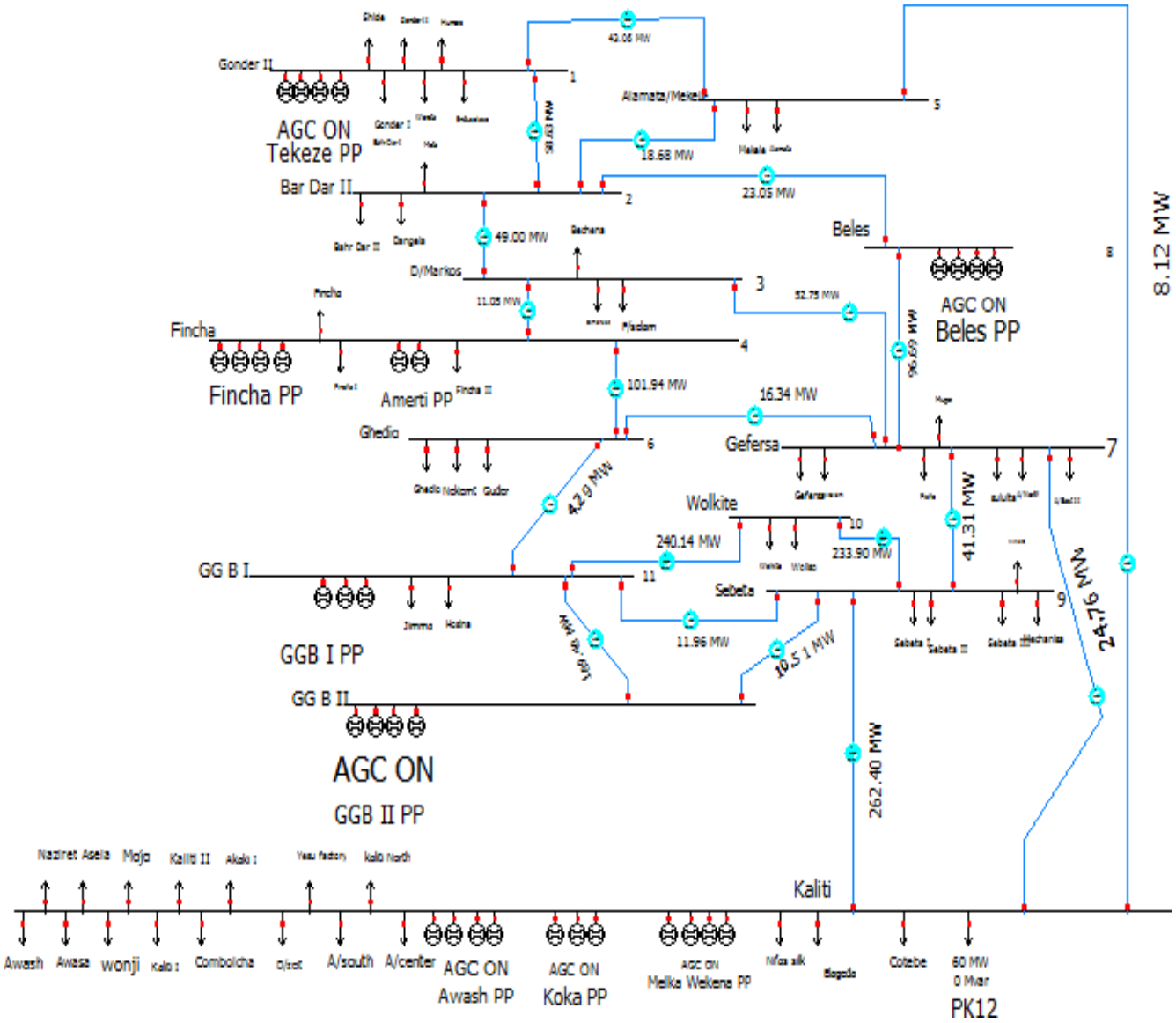


Fig. 3. Single line diagram of 230KV grid

Case Studies

The case has been conducted on the line outage from Sebeta to Kaliti as being informed by NGCC. The study considered four cases for further investigation of the line outage effect analysis.

Case One: - Normal State

As per the collected data from Dispatch Center most of the time outage of a single transmission line on the network does not have more effects over others.

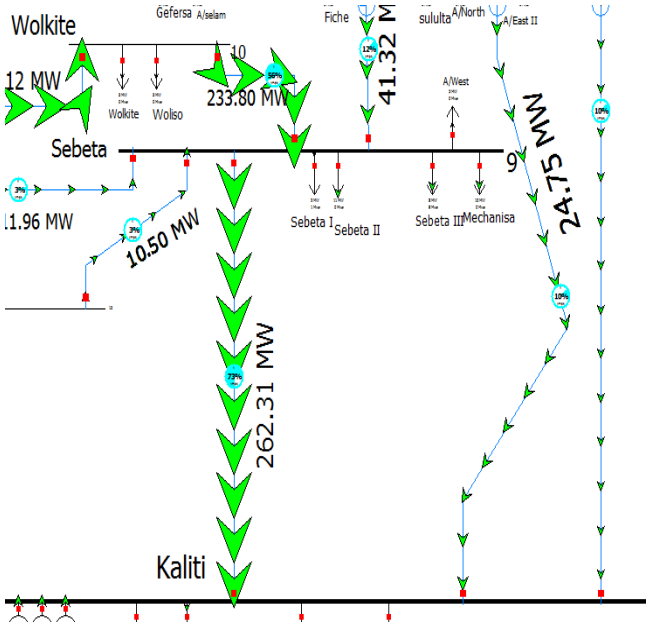


Fig. 4. Line normal state

The outage of Sebeta to Kaliti transmission line causes for a loading effect over others that lead the network to a partial blackout. The line is even overloaded (about 73% loading) under normal condition as shown in the fig. 4 above.

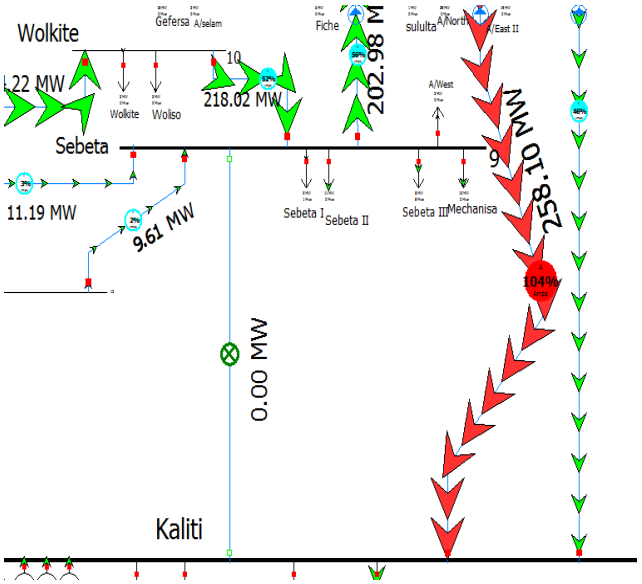


Fig. 5. Simulation results during line outage

Case Two:- When Sebeta to Kaliti Line is out of the system

Sebeta to Kaliti line outage causes highly overloading of Gefersa to Kaliti line which have a line loading of 104% as shown in the fig. 5 above. It indicates that the line will go to emergency and alert states because of its loading beyond their rated capacity.

Case Three:- The cascaded outage of Sebeta to Kaliti and Gefersa to Kaliti

Since, the outage of Sebeta to Kaliti causes overload on Gefersa to Kaliti transmission line.

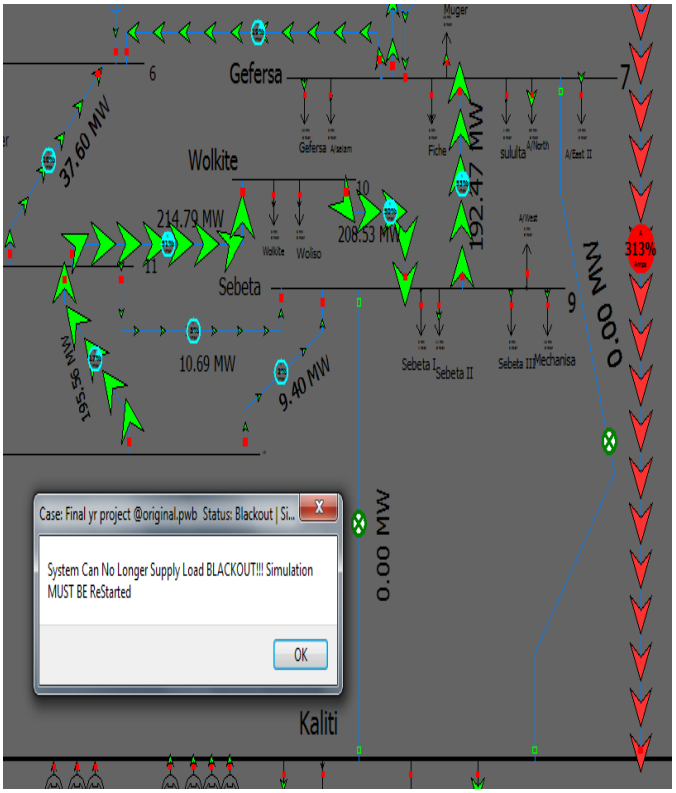


Fig. 6. The total black out due to cascaded outage

Due to this reason, the protective devices (relay and circuit breaker) are forced to trip the line from the system then a cascaded outage is happening. Finally, this cascaded outage will cause a total blackout as shown in fig. 6 above.

Case Four: - Outage of Sebeta to Kaliti line and the effect of using D – FACT devices

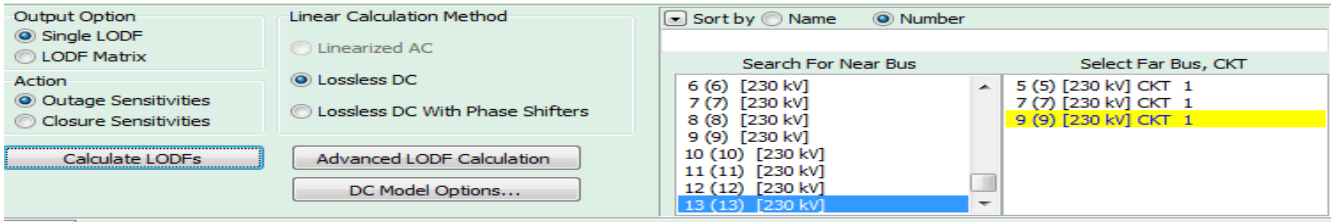
Lines are ranked in accordance with their sensitivity (% LODF) due to Sebeta to Kaliti line outage. The line has the most negative % LODF takes the first rank. Then, depending upon their rank the D-FACT devices are inserted on the most sensitive one (most negative %LODF) line.

DSSC Specification Calculation and Placement

The following steps have been considered in designing and sizing of the device:

1) Calculating line outage sensitivity (% LODF) and selecting the transmission line with the most negative % LODF. As Table 2 shows, Gefersa to Kaliti transmission line (7 to 13) is with the most negative % LODF.
2) The line inductance is 141881.25μH;
3) Percentage of maximum line impedance compensation specified is 80%;
4) Available impedance in DSSC to be injected: $X_{injected}$ = 0.8 * 141881.25μH= 113505 μH;

Table 2. LODF for line outage



	From Number	From Name	To Number	To Name	Circuit	% LODF	MW From	MW To	CTG MW From
1	1	1	2	2	2	11.2	58.6	-58.6	29.4
2	1	1	5	5	1	-11.2	43.1	-41.9	72.3
3	2	2	3	3	1	10.4	49.0	-48.7	21.9
4	2	2	5	5	1	-4.9	18.7	-18.2	31.4
5	2	2	8	8	1	5.7	-23.1	23.1	-37.9
6	3	3	4	4	1	5.2	-11.1	11.1	-24.6
7	3	3	7	7	1	5.2	52.7	-52.2	39.2
8	4	4	6	6	1	5.2	101.9	-101.1	88.4
9	5	5	13	13	1	-16.1	8.1	-8.0	50.1
10	6	6	7	7	1	-1.6	16.3	-16.3	20.6
11	6	6	11	11	1	6.8	-4.3	4.3	-22.1
12	8	8	7	7	1	5.7	96.7	-96.5	81.9
13	7	7	9	9	1	93.2	41.3	-41.3	-202.2
14	7	7	13	13	1	-83.9	24.8	-24.6	244.1
15	10	10	9	9	1	6.2	233.9	-233.7	217.6
16	11	11	9	9	1	0.3	12.0	-11.9	11.1
17	9	9	12	12	1	-0.3	-10.5	10.5	-9.8
18	9	9	13	13	1	100.0	262.4	-261.3	1.1
19	11	11	10	10	1	6.2	240.1	-239.9	223.8
20	11	11	12	12	1	0.3	-189.4	189.5	-190.1

5) Available $X_{injected}$ per module = 47 μH;
6) Total No. DSSC needed = ($X_{injected}$) / (Avail $X_{injected}$ per module)
$=113505\mu H/(47\ \mu H/module)$
= 2415 modules
7) Determining transmission line rated current, present and emergency state current flow through the targeted transmission line.
$I_{thermal}$ = 627.55A, $I_{present}$ = 63.9A,
$I_{emergency}$ = 652.652A;
8) Determining the triggering current (I_0) and maximum limit current (I_{lim}):
% for I_0 setting = $I_{present}/I_{thermal}$ = 10.2 %, then
$I_0 \geq$ 10 % of $I_{thermal}$ = 64A;
% for I_{lim} setting = $I_{emergency}$ / $I_{thermal}$ = 104%,
Then $I_{lim} \geq I_{thermal}$ = 652.652A;
9) Rated Current after DSSC devices inserted is 593.33A.
Therefore, 593.33A $\leq I_{rated}$ = 627.55A.
So, the Gefersa to Kaliti transmission line can withstand during Sebeta to Kaliti transmission line congestion.
10) From step 9, it indirectly proves that real power flow when DSSC inserted in targeted transmission line while the system is in emergency state is less or equal to rated real power flow in normal state.
$P_{rated} = \sqrt{3}*V_{rated}*I_{rated}$ = 237.5 MW
$P_{rated\text{-}after\text{-}DSSC\text{-}inserted}$ = 224.6 MW $\leq$ 237.5 MW
11) Check. 224.6 MW $\leq$ 237.5 MW, so it is OK!

Hence, the most sensitive line is Gefersa to Kaliti about -83%. These D-FACT devices inject magnetizing impedance value of 0.08pu. After the D-FACTS devices get inserted into a sensitive transmission line, line loading gets reduced from 104% to 95%. Now, as long as the line loading is below 100%, the system can withstand and able to serve.

Therefore, the D-FACT device selection is depending upon the present current flow at normal state and the current flow at emergency state. After D-FACT is inserted, the current passing through the line must be less than or equal to line rated current.

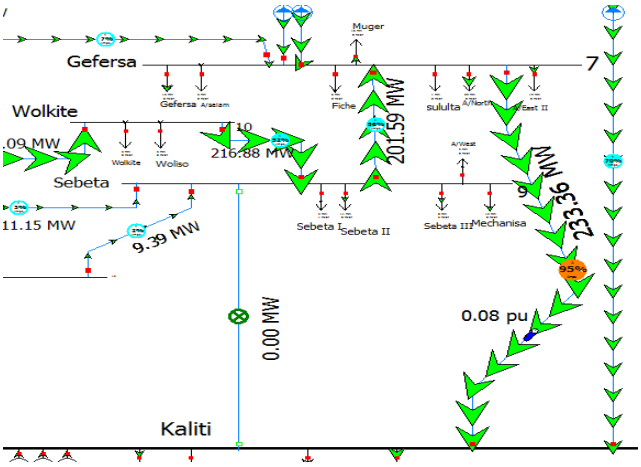


Fig. 7. After D-FACTS devices inserted

Table 3. MW flow and percentage loadings

Node to Node	Normal State		Emergency State		After DFACT Inserted	
	MW	MVA	MW	MVA	MW	MVA
Gefersa to Kaliti	4.7	10	258	104	233	95

Table 4. Setting of D-FACTS devices

X_{pe}	I_o% of $I_{thermal}$	I_{lim}% of $I_{thermal}$	Max % of	X_{inj}	Num	I_o (A)	I_{lim} (A)
47	10	104	80	235	2415	62.8	652.7

Other Cases

Outages of the other transmission lines have been tested one by one, but MVA limit violation has not been observed. But it is difficult to conclude at there is no transmission line MVA limit violation since load demand increases forever. As

the time goes on the transmission line overloading also increases in proportion to load demand.

4. Result and Discussion

At normal state the percent MVA loading and MW flow of the transmission line from Sebeta to Kaliti is higher than the others. It is about 73% MVA loading and 262.39 MW respectively.

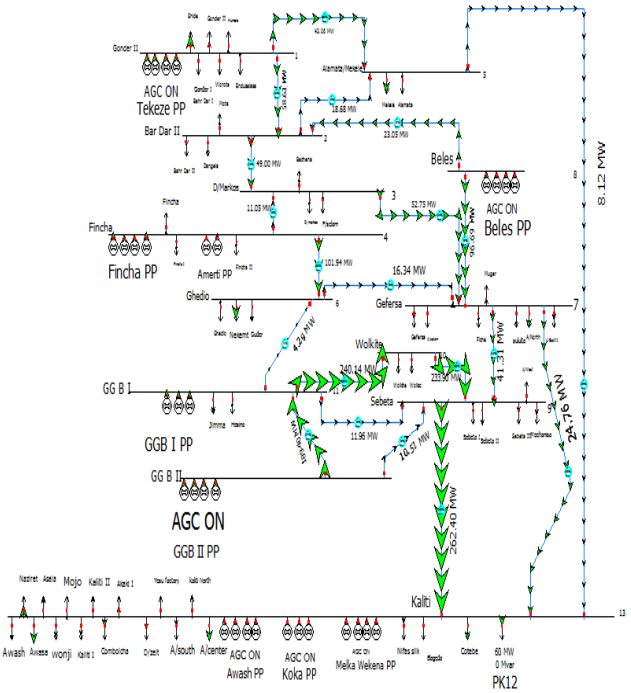


Fig. 8. Overall simulation result in normal state

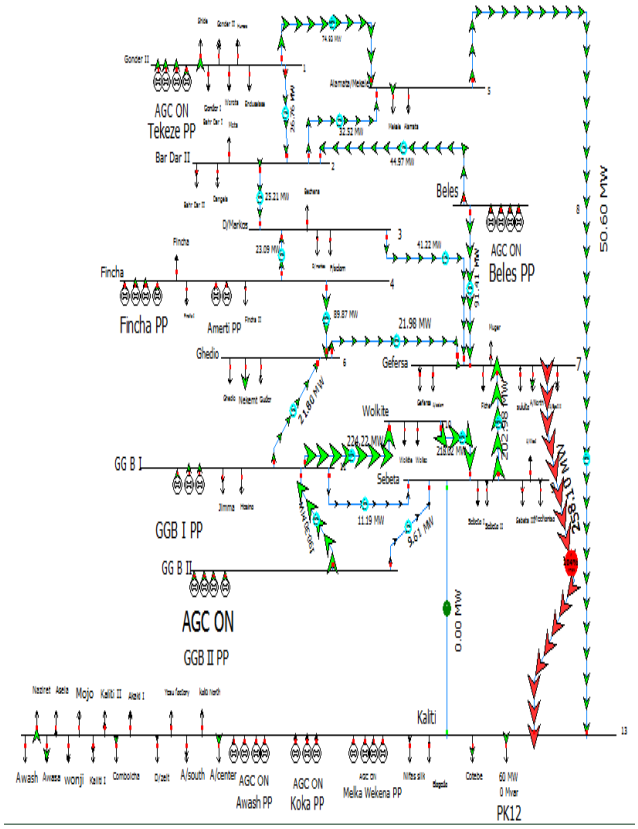


Fig. 9. Simulation result at emergency state

Both %MVA loading and MW flow of each line show at different states due to Sebeta to Kaliti line outage in Table 5 below.

The outage of Sebeta to Kaliti transmission line is not only cause overloading on Gefersa to Kaliti but also disturb all other lines in the network by increasing the percentage of loading and MW flow even though lines did not get overloaded. This assures that during the emergency of transmission line outage, both MVA percent loading and MW flows fluctuate unexpectedly.

When Sebeta to Kaliti line outage occur from the network due to some emergency cases, Gefersa to Kaliti line goes out by protective devices since it is running to be beyond its MVA limit. Consequently, the cascaded outage of Sebeta to Kaliti and Gefersa to Kaliti transmission lines, as it discussed above, it leads the network to the total system blackout, see fig.10.

When D-FACTS device inserted into the Gefersa to Kaliti line, according to the % LODF calculated, these devices reduce the percentage of loading and the megawatt flow of the Gefersa to Kaliti line by injecting magnetizing impedance about a value of 0.08pu.

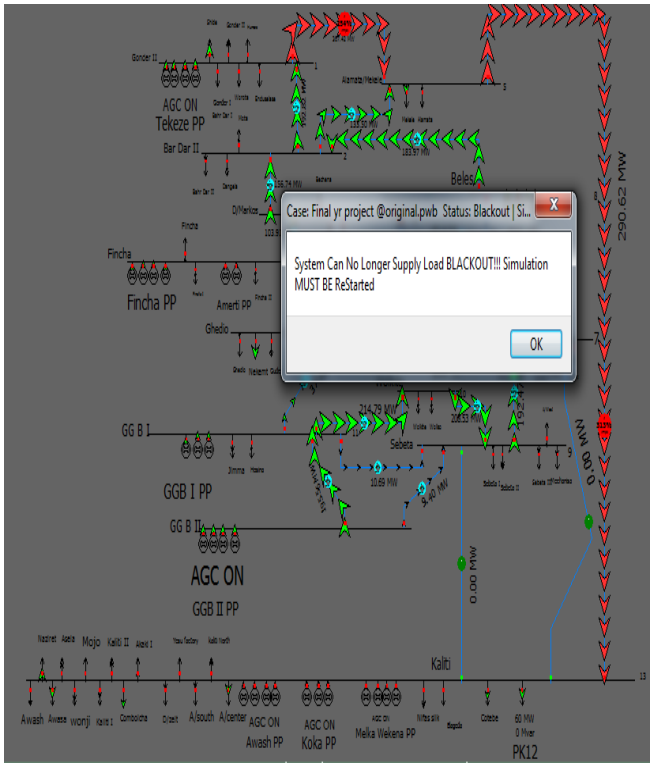


Fig. 10. Overall simulation result for cascaded outage of the two transmission lines

It reduce about 9% of MVA loading and 24.7 MW flow, which results in avoiding the transmission line from being overloaded and enable it to give service though it is still in warning i.e. about 95%.

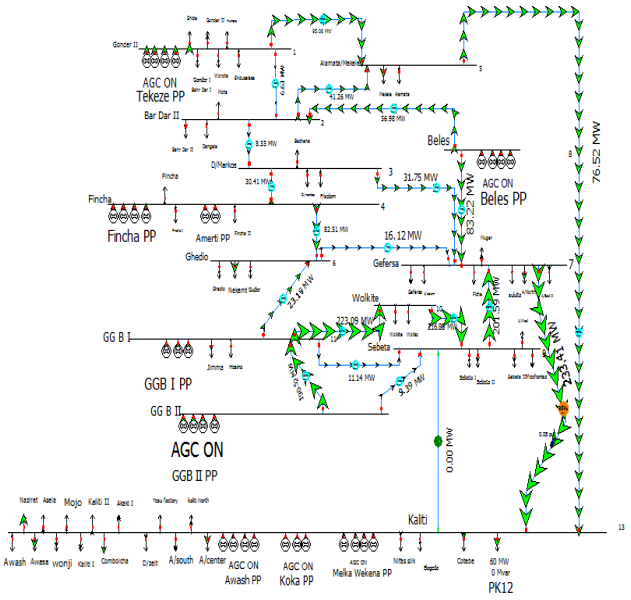


Fig. 11. Overall simulation result in emergency state when D-FACTS devices are inserted

Table 5. Percent MVA loading and MW flow of each transmission line at different states

Node to Node	Normal State		Emergency State		After D-Facts Insert	
	MW	MVA (%)	MW	MVA (%)	MW	MVA (%)
Gondar II to B/Dar II	58.63	15	26.76	7	6.63	2
B/Dar II to D/Mar	49	12	25.21	6	8.35	2
D/Mar to Fincha	11.05	3	23.09	6	30.45	7
Fincha to Ghedio	101.9	26	89.87	23	82.51	21
Ghedio to GGB I	4.29	1	21.8	6	23.19	6
GGB I to GGB II	189.4	17	190.3	16	190.5	16
Gondar II to Alemata	43.1	36	74.93	63	95.1	79
B/Dar II to Alemata	18.7	5	32.52	9	41.3	12
Alemata to Kaliti	8.1	10	50.6	46	76.5	70
Beles to B/Dar II	23.0	2	44.97	4	56.9	5
Beles to Gefersa	96.7	8	91.41	8	83.2	7
Wolkite to GGB I	240.1	58	224.2	54	223	54
Ghedio to Gefersa	16.34	8	21.98	10	16.1	7
Wolkite to sebeta	233.9	56	218.0	52	216.8	52
Sebeta to GGB II	10.5	3	9.61	2	9.39	2
Gefersa to Sebeta	41.31	12	202.9	56	201.6	56
Sebeta to Kaliti	262.4	73	0	0	0	0
Gefersa to Kaliti	4.72	10	258.1	104	233.4	95

But it will withstand as long as MVA loading is below its rating and can give service so that total network reliability and security are assured.

5. Conclusion

230KV transmission line contingency analysis of Ethiopia's power network is very important for the security and reliability of the system, since it is the high voltage next to 400KV line. The contingency occurs due to the outage of a single line in the network and it causes overloading on the other line. This overloading of a line may bring insulation failure and disturbance in all systems. To overcome this problem D- FACTS devices are the most preferable, efficient, cheap and applicable technology.

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Bending Deflection Analysis of a Semi-Trailer Chassis by Using Symmetric Smoothed Particle Hydrodynamics

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Abstract- In this paper, a simple approach is presented for the calculation of bending deflection of a semi trailer chassis. The 3D model of the chassis is used to obtain the function of the moment of inertia and then the mathematical model of the chassis is presented as an Euler Bernoulli Beam which has the variable cross section. Different loading conditions raised from the semi trailer test procedures are applied. The bending deflections of the semi trailer chassis are numerically calculated by using the Symmetric Smoothed Particle Hydrodynamics (SSPH) method. The first time, the performance of the SSPH method for the fourth order non-homogeneous variable coefficents linear boundary value problems is evaluated. For the calculations different numbers of terms in the TSEs are employed when the number of nodes in the problem domain increases. The comparisons are made with the results of experiments. It is observed that the SSPH method has the conventional convergence properties and yields smaller L_2 error. Finally, the approach presented here may be used for the calculation of deflection of the semi trailer chassis before the release of detail design.

Keywords Meshless methods, strong form, Taylor series expansion, element free method, computational mechanics.

1. Introduction

The choice of basis functions is one of the most important issues to obtain the approximate solution of an initial boundary value problem in numerical methods. One can improve the accuracy of the numerical solution either by increasing number of nodes or by increasing the degree of complete polynomials which are defined piecewise on the problem domain in the Finite Element Method. To find an approximate solution of an initial boundary value problem the basis functions to be used in meshless methods can be derived by Smoothed Particle Hydrodynamics (SPH) method, proposed by Lucy [1], Corrected Smoothed Particle Method (CSPM) [2, 3], Reproducing Kernel Particle Method (RKPM) [4-6], Modified Smoothed Particle Hydrodynamics (MSPH) method [7-10], the SSPH method [11-14] and the Strong Form Meshless Implementation of Taylor Series Method (SMITSM) [15-16], Moving Kringing Interpolation Method [17-18], the meshless Shepard and Least Squares (MSLS) Method [19].

The locations of nodes are only the parameters which are necessary to construct basis functions in the SSPH method. These basis functions can be found similar to those in the Finite Element Methods however the derivatives of a function can be found without differentiating the basis function. Of course, the basis for the derivatives of a function can be obtained by differentiating the basis for the function as in the Finite Element Methods and meshless methods.

Because of the formulation of the Symmetric Smoothed Particle Hydrodynamics (SSPH) method the matrix to be inverted becomes symmetric and this reduces the CPU time. Moreover, the SSPH method eliminates the choice of weight function which must not be a constant. The SSPH method depends on the Taylor Series Expansion and calculates the value of the solution at a node by using the values of the solution at the other nodes and then substitutes it into the governing differential equation. The SSPH method has been successfully applied to 2D homogeneous elastic problems including quasi-static crack propagation [11-13] and 2D Heat Transfer problems.

A semi trailer chassis has a very complex structure and the structural analyses based on the bending deflections are generally performed by using commercial Finite Element Analysis software. This activity is costly and time consuming. Since the less deflection becomes a unique

selling point of a semi trailer, during conceptual and detail design phases of the new product development process the mentioned analysis should be performed to obtain an acceptable chassis design which is validated by a series of tests. In this paper, an approach which is simple and requires less effort than the Finite Element Methods is presented for the calculation of deflection of a semi trailer chassis. First of all, by using the 3D data of the chassis a function for the moment of inertia of the cross section is created and then the chassis is modelled as Euler Bernoulli Beam. Different loading conditions which cause bending for the semi trailer chassis coming from the semi trailer test procedures are applied. The bending deflections of the semi trailer chassis are numerically calculated by using the SSPH method. Also, the performance of the SSPH method is evaluated by employing different number of terms in the associated Taylor Series Expansions and the calculation of deflection of a semi trailer chassis is studied then, comparisons are made with the results of experiments.

In section 2, the formulation of the SSPH method is presented for 1D application. In section 3, the chassis of the semi trailer is modelled as a beam based on Euler Bernoulli beam theory. The moment of inertia of the Euler Bernoulli beam is defined as a function by using the moment of inertia values of totally 23 sections due to the non-uniform structure of the semi trailer chassis. In Section 4, two types of loading conditions are investigated. The performance of the Symmetric Smoothed Particle Hydrodynamics (SSPH) method is compared with the experimental results.

2. Formulation

If a function f(x) is continuous and differentiable up to the $(n+1)^{th}$ order, through the Taylor Series Expansion (TSE) the value of the function at a point $\xi = (\xi_1)$ located in the neighborhood of $x = (x_1)$ can be approximated as following

$$f(\xi_1) = \sum_{m=0}^{n} \frac{1}{m!}[(\xi_1 - x_1)\frac{\partial}{\partial x_1}]^m f(x_1) \quad (1)$$

If the eight and higher order terms are neglected, and matrices $\mathbf{P}(\xi, x)$ and $\mathbf{Q}(x)$ are introduced, one can write equation (1) as

$$f(\xi) = \boldsymbol{P}(\xi, x)\boldsymbol{Q}(x) \quad (2)$$

Where

$$\boldsymbol{Q}(x) = [\, f(x), \frac{df(x)}{dx_1}, \frac{1}{2!}\frac{d^2 f(x)}{dx_1^2}, \dots, \frac{1}{n!}\frac{d^7 f(x)}{dx_1^7}]^T \quad (3)$$

$$\boldsymbol{P}(\xi, x) = [1, (\xi_1 - x_1), (\xi_1 - x_1)^2, \dots, (\xi_1 - x_1)^7] \quad (4)$$

The unknown variables which are the elements of the $\mathbf{Q}(x)$, the estimate of the function, its first derivatives to seventh derivatives at $x = (x_1)$ can be found from equation (2).

Both sides of equation (2) are multiplied with $W(\xi, x)\mathbf{P}(\xi, x)^T$ and the following equation is obtained.

$$f(\xi)W(\xi, x)\boldsymbol{P}(\xi, x)^T = \boldsymbol{P}(\xi, x)\boldsymbol{Q}(x)W(\xi, x)\boldsymbol{P}(\xi, x)^T,$$
$$= [\boldsymbol{P}(\xi, x)^T W(\xi, x)\boldsymbol{P}(\xi, x)]\boldsymbol{Q}(x) \quad (5)$$

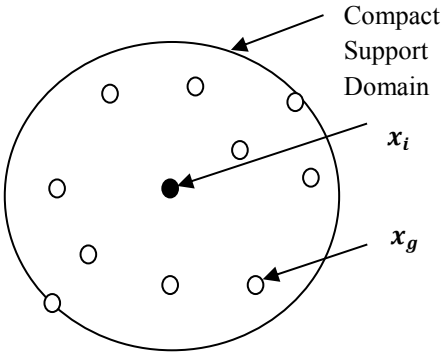

Fig. 1. Distribution of the nodes in the compact support of the kernel function $W(\xi, x)$ associated with the point $x = (x_i, y_i)$

In the compact support domain of the weight function $W(\xi, x)$ associated with the point $x = (x_1)$ shown in Figure 1, let there be $N(x)$ nodes and $g(j)$ is the j^{th} node in the compact support of $W(\xi, x)$. Equation (5) is evaluated at every node in the compact support domain of the $W(\xi, x)$**.** By summation of each side over these nodes to find out

$$\sum_{j=1}^{N(x)} f(\xi^{g(j)})\, W(\xi^{g(j)}, \boldsymbol{x})\boldsymbol{P}(\xi^{g(j)}, x)^T$$
$$= \sum_{j=1}^{N(x)} [\boldsymbol{P}(\xi^{g(j)}, x)^T\, W(\xi^{g(j)}, x)\boldsymbol{P}(\xi^{g(j)}, x)]\, \boldsymbol{Q}(x) \quad (6)$$

Where $\xi^{g(j)}$ defines the coordinates of the node $g(j)$. By using the following definitions

$$\boldsymbol{H}(\xi, x) = \left[\, \boldsymbol{P}^T(\xi^{g(1)}, x), \boldsymbol{P}^T(\xi^{g(2)}, x), \dots, \boldsymbol{P}^T(\xi^{g(N(x))}, x)\right],$$

$$\boldsymbol{W}(\xi, x) = \begin{bmatrix} W(\xi^{g(1)}, x) & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & W(\xi^{g(N(x))}, x) \end{bmatrix},$$

$$\boldsymbol{F}^{(x)T}(\xi, x) = [f(\xi^{g(1)}), f(\xi^{g(2)}), \dots\dots, f(\xi^{g(N(x))}] \quad (7)$$

Equation (6) can be written as

$$\boldsymbol{H}(\xi, x)\, \boldsymbol{W}(\xi, x)\boldsymbol{F}^{(x)}(\xi, x) =$$
$$\boldsymbol{H}(\xi, x)\, \boldsymbol{W}(\xi, x)\boldsymbol{H}(\xi, x)^T\boldsymbol{Q}(x) \quad (8)$$

The values of the matrix $\mathbf{P}(\xi, x)$, the weight function $W(\xi, x)$ and the function f at all nodes located in the compact support domain of $W(\xi, x)$ associated with point x are the elements which determine the values of element matrices $\mathbf{H}(\xi, x), \mathbf{W}(\xi, x)$ and $\mathbf{F}^{(x)}(\xi, x)$. Then, equation (8) can be written as

$$\boldsymbol{C}(\xi, x)\boldsymbol{Q}(x) = \boldsymbol{D}(\xi, x)\boldsymbol{F}^{(x)}(\xi, x) \quad (9)$$

Where $\mathbf{C}(\xi, x) = \mathbf{H}(\xi, x)\, \mathbf{W}(\xi, x)\mathbf{H}(\xi, x)^T$ and $\mathbf{D}(\xi, x) = \mathbf{H}(\xi, x)\, \mathbf{W}(\xi, x)$.

It can be easily seen that the matrix $\mathbf{C}(\xi, x)$ defined above is symmetric. That's why this method is called as the SSPH method. The simultaneous linear algebraic equations given in equation (3.9) can be solved to obtain the unknown elements of the $\mathbf{Q}(x)$. The matrix $\mathbf{C}(\xi, x)$ to be inverted is symmetric. Because of symmetry property of the matrix $\mathbf{C}(\xi, x)$, the CPU

time which is needed to solve equation (9) for the unknown elements of the $\mathbf{Q}(x)$ can be reduced. The matrices given in equation (9) do not include the derivatives of the weight function. By using a much larger class of weight functions including a constant the implementation and usefulness of the method can be improved.

For the non-singular matrix $\mathbf{C}(\xi, x)$, the solution of equation (9) is

$$\boldsymbol{Q}(x) = \boldsymbol{C}(\xi,x)^{-1}\boldsymbol{D}(\xi,x)\boldsymbol{F}^{(x)}(\xi,x)$$

$$= \boldsymbol{K}^{(x)}(\xi,x)\boldsymbol{F}^{(x)}(\xi,x) \quad (10)$$

and $\mathbf{K}^{(x)}(\xi, x) = \mathbf{C}(\xi, x)^{-1}\mathbf{D}(\xi, x)$. Equation (10) can be written as

$$\boldsymbol{Q}(x) = \boldsymbol{K}(\xi,x)\boldsymbol{F}(\xi) \quad (11)$$

$$\boldsymbol{F}(\xi) = [\, f(\xi^1), .., f\left(\xi^{g(1)}\right), .., f\left(\xi^{g(N(x))}\right), \dots, f(\xi^M)\,]^T \quad (12)$$

Where M is the total number of nodes in the problem domain. Alternatively, one can write equation (11) as following

$$Q_I(x) = \sum_{J=1}^{M} K_{IJ}F_J \;, \quad I = 1,2,\dots,8 \quad (13)$$

Where $F_J = f(\xi^J)$. The value of the function and its derivatives at the point **x** are defined in terms of values of the function at all nodes in the problem domain. Eight components of equation (13) for 1 D case are given as following

$$f(x) = Q_1(x) = \sum_{J=1}^{M} K_{1J}F_J$$

$$\frac{\partial f(x)}{\partial x_1} = Q_2(x) = \sum_{J=1}^{M} K_{2J}F_J$$

$$\frac{\partial^2 f(x)}{\partial x_1^2} = 2!\,Q_3(x) = \sum_{J=1}^{M} K_{3J}F_J$$

$$\frac{\partial^3 f(x)}{\partial x_1^3} = 3!\,Q_4(x) = \sum_{J=1}^{M} K_{4J}F_J$$

$$\frac{\partial^4 f(x)}{\partial x_1^4} = 4!\,Q_5(x) = \sum_{J=1}^{M} K_{5J}F_J$$

$$\frac{\partial^5 f(x)}{\partial x_1^5} = 5!\,Q_6(x) = \sum_{J=1}^{M} K_{6J}F_J$$

$$\frac{\partial^6 f(x)}{\partial x_1^6} = 6!\,Q_7(x) = \sum_{J=1}^{M} K_{7J}F_J$$

$$\frac{\partial^7 f(x)}{\partial x_1^7} = 7!\,Q_8(x) = \sum_{J=1}^{M} K_{8J}F_J \quad (14)$$

The formulation for 2D and 3D problems can be found [11-14].

3. Modelling of the Semi-Trailer Chassis

By using the 3D model of the semi-trailer chassis, 1D Euler Bernoulli beam model is presented in this section. As it is very well known and can be seen from the Figure 2, the semi-trailer chassis has a very complex structure. The deflection of the chassis regarding to the various loading conditions can be computed by using commercial finite element analysis software. But the aim of this study is not to compare the performance of meshless methods mentioned above with FEM software.

Fig. 2. 3D Model of a Semi Trailer Chassis

During the new product development process, the semi-trailer chassis can be modified which are considered major modifications several times. For each major modification, to perform and repeat the finite element analysis with FEM software is a costly and time consuming activity because of re-meshing. Motivated by the fact that the performing and repeating finite element analysis is costly and time consuming, an alternative approach is investigated. 3D dimensional semi-trailer chassis is modelled as 1D dimensional beam based on Euler Bernoulli beam theory. To determine the moment of inertia of the beam is the most difficult part of mentioned modelling phase. It is found that the moment of inertia of the Euler Bernoulli beam can be defined as a function by using the moment of inertia values from the different sections of the chassis. It has to be mentioned that the selection of the sections is not a random activity; it is based on the design experience and engineering knowledge in terms of strength of materials. Totally 23 sections are selected to present the moment of inertia function of the semi-trailer chassis. The 23 sections can be seen from Figure 2. By using these moment of inertia values, the moment of inertia function of the 1D dimensional beam is obtained with POLYFIT function of MATLAB.

4. Numerical Results

The SSPH method is applied to solve the two problems of which are with different loading and boundary conditions in this section. The results of SSPH method employing different number of terms in the TSEs are compared with each other. Nonetheless, the SSPH method can be easily applied to any boundary value problem and complex domains in a systematic way.

4.1 Simply Supported Beam with Partially Distributed Load

A distributed load is applied to the simply supported beam shown in Figure 3 and according to this loading

condition (case 1) the fourth order governing equation can be given as follows [20]

$$\frac{d^2}{dx^2}\left(EI(x)\frac{d^2w}{dx^2}\right) = q(x) \qquad (15)$$

where the E is modulus of elasticity, I(x) is the moment of inertia of the cross section, w is the deflection of the neutral axis and the q(x) is the distributed load.

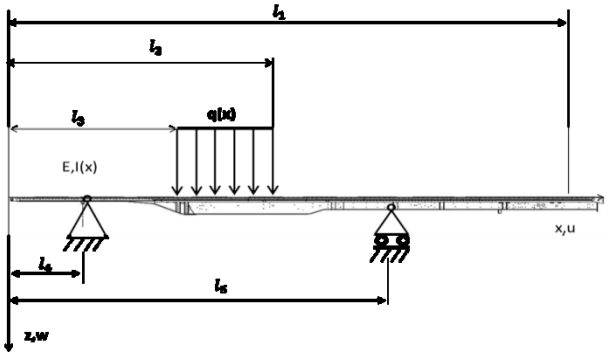

Fig. 3. Simply Supported Beam – Load Case 1

The physical parameters are as follows;

$l_1 = 13.6\ m, l_2 = 5.95\ m, l_3 = 4.45\ m,$

$l_4 = 1.65\ m, l_5 = 8.85\ m$

Modulus of elasticity E is 210 GPa and the distributed load q is set to 113513 N/m. The weight of the trailer chassis is neclegted. The boundary conditions are given as follows;

$$x = 0, \quad \frac{d^2w}{dx^2} = 0 \ and \ \frac{dI}{dx}\frac{d^2w}{dx^2} + I\frac{d^3w}{dx^3} = 0$$

$$x = l_1, \quad \frac{d^2w}{dx^2} = 0 \ and \ \frac{dI}{dx}\frac{d^2w}{dx^2} + I\frac{d^3w}{dx^3} = 0$$

$$l_2 \le x \le l_3, \frac{d^2w}{dx^2} = 0, \frac{d^2I}{dx^2}\frac{d^2w}{dx^2} + 2E\frac{dI}{dx}\frac{d^3w}{dx^3} + EI\frac{d^4w}{dx^4} = -q$$

$$x = l_4, \quad \frac{d^2w}{dx^2} = 0 \ and \ w = -0.013\ m$$

$$x = l_5, \quad \frac{d^2w}{dx^2} = 0 \ and \ w = 0\ m$$

The above forth order homogeneous variable coefficients boundary value problem is solved by using the SSPH method for the node distributions of 141, 273 and 545 in the problem domain employing different number of terms in the TSEs. The following Revised Super Gauss Function in [11] is used for each loading conditions as the weight function since it resulted in the least L_2 error norms in numerical solutions presented in [11].

$$W(x,\xi) = \frac{G}{(h\sqrt{\pi})^{\lambda}}\begin{Bmatrix}(36-d^2)\,e^{-d^2} & 0 \le d \le 6\\ 0 & d > 6\end{Bmatrix} \qquad (16)$$

where $d = |x-\xi|/h$ is the radius of the support domain which is set to 6, h is the smoothing length, λ is equal to the dimensionality of the space (i.e., λ=1, 2 or 3) and G is the normalization parameter having the values 1.04823, 1.10081 and 1.18516 for λ = 1, 2 and 3, respectively. It is chosen that the smoothing length h=1.5Δ for two adjacent nodes for the examples studied in this paper. Numerical results obtained by using the SSPH method employing different number of terms in the TSEs are compared with the experimental, and their convergence and accuracy features are evaluated by using the following global L_2 error norm

$$\|Error\|_2 = \frac{\left[\sum_{j=1}^{m}(w_{num}^j - w_{exact}^j)^2\right]^{1/2}}{\left[\sum_{j=1}^{m}(w_{exact}^j)^2\right]^{1/2}} x100 \qquad (29)$$

where v_{num}^j is the value of numerical solution v at the j^{th} node and v_{exact}^j is the value of analytical solution at the j^{th} node.

Global L_2 error norms of the solutions of SSPH method are given in Table 1, where numbers of nodes and terms in TSEs are varying. The results in Table 1 are obtained for the parameter values of d and h that yield the best accuracy. The compact support domain radius d is equal to 6 and smoothing length $h = 1.5\Delta$. It is clear that, even with the same number of terms, solutions of the SSPH method agree very well with the analytical solution.

To evaluate the performance of the SSPH method, numerical solutions are obtained for 5 to 8 terms in the TSEs. It is observed that the rate of convergence of the numerical solution increases with an increase in the degree of complete polynomials. However, with the same number terms in the TSEs, the convergence rate of the SSPH method is decreasing even the number of nodes is increased in the problem domain.

Table 1. Global L_2 error norm for different number of nodes and terms in the TSEs

Number of Terms	Number of Nodes in the Problem Domain		
	141	273	545
5	18.24	13.92	12.56
6	17.58	12.89	11.46
7	17.13	12.03	10.49
8	16.76	11.07	9.63

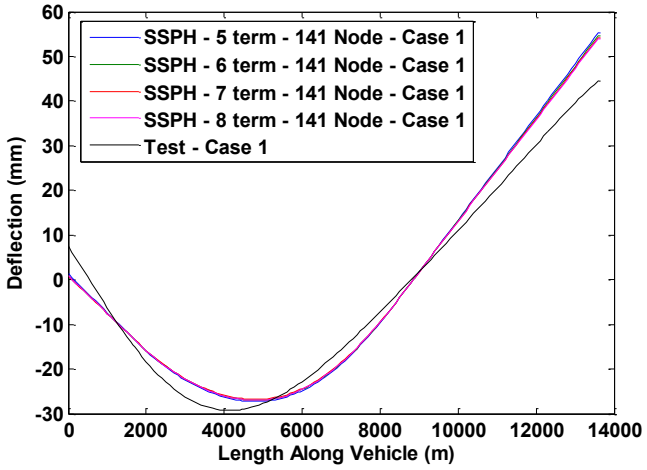

Fig. 4. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 141 nodes are used

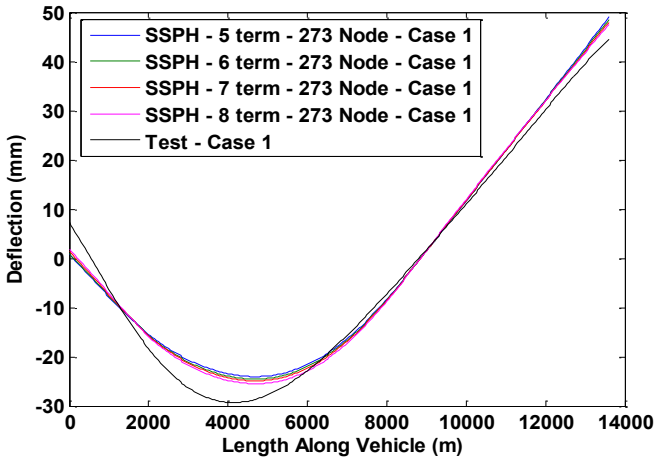

Fig. 5. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 273 nodes are used

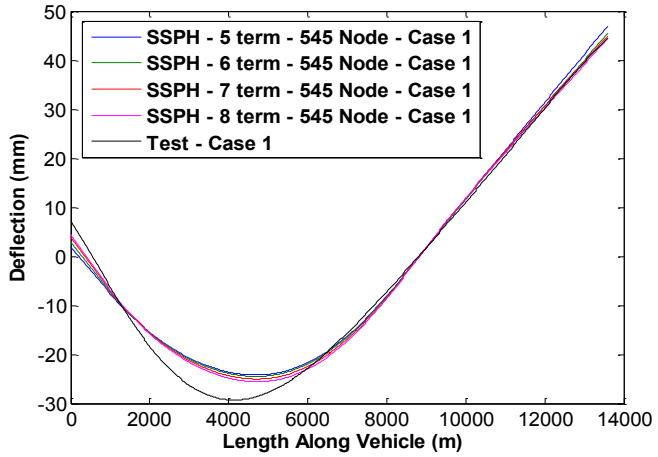

Fig. 6. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 545 nodes are used

It is observed in Figures 4 to 6 that accuracy of the SSPH method increases as the number of nodes and terms in the TSEs is increased.

4.2 Simply Supported Indeterminate Beam with Partially Distributed Load

Equally spaced distributed loads (case 2 - concrete blocks) are applied to the simply supported beam shown in Figure 7.

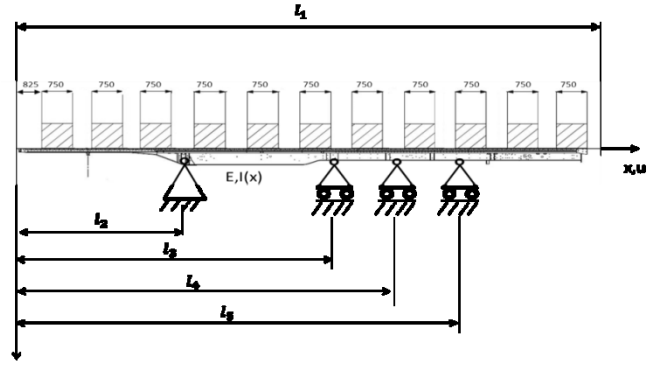

Fig. 7. Simply Supported Beam – Load Case 1

The physical parameters are as follows;

$l_1 = 13.6\ m,\ l_2 = 3.75\ m,\ l_3 = 7.5\ m,$

$l_4 = 8.85\ m, l_5 = 10.15\ m$

Modulus of elasticity E is 210 GPa and the an equally spaced distributed load q is set to 37575 N/m. The boundary conditions are given as follows;

$$x = 0,\quad \frac{d^2w}{dx^2} = 0\ and\ \frac{dI}{dx}\frac{d^2w}{dx^2} + I\frac{d^3w}{dx^3} = 0$$

$$x = l_1,\quad \frac{d^2w}{dx^2} = 0\ and\ \frac{dI}{dx}\frac{d^2w}{dx^2} + I\frac{d^3w}{dx^3} = 0$$

$$x = l_3,\quad \frac{d^2w}{dx^2} = 0, w = 0.0005\ m$$

$$x = l_4,\quad \frac{d^2w}{dx^2} = 0\ and\ w = 0.0014\ m$$

$$x = l_5,\quad \frac{d^2w}{dx^2} = 0\ and\ w = 0.0005\ m$$

$$Nodes\ at\ concrete\ blocks$$

$$\frac{d^2I}{dx^2}\frac{d^2w}{dx^2} + 2E\frac{dI}{dx}\frac{d^3w}{dx^3} + EI\frac{d^4w}{dx^4} = -q$$

Global L_2 error norms of the solutions of SSPH method are given in Table 2, where numbers of nodes and terms in TSEs are varying. The results in Table 1 are obtained for the parameter values of d and h that yield the best accuracy. The compact support domain radius d is equal to 6 and smoothing length $h = 1.5\Delta$. It is clear that, even with the same number of terms, solutions of the SSPH method agree very well with the analytical solution. To evaluate the performance of the SSPH method, numerical solutions are obtained for 5 to 8 terms in the TSEs. It is observed that the rate of convergence of the numerical solution increases with an increase in the degree of complete polynomials. Moreover, with the same number terms in the TSEs, the convergence rate of the SSPH method is increasing as the number of nodes is increased in the problem domain.

Table 2. Global L_2 error norm for different number of nodes and terms in the TSEs

Number of Terms	Number of Nodes in the Problem Domain		
	141	273	545
5	35.89	33.95	27.42
6	35.48	30.09	25.01
7	33.75	28.69	22.61
8	31.18	27.33	19.91

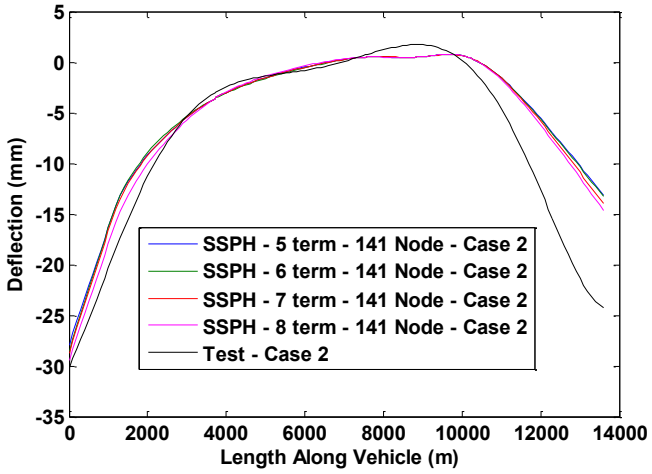

Fig. 8. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 141 nodes are used

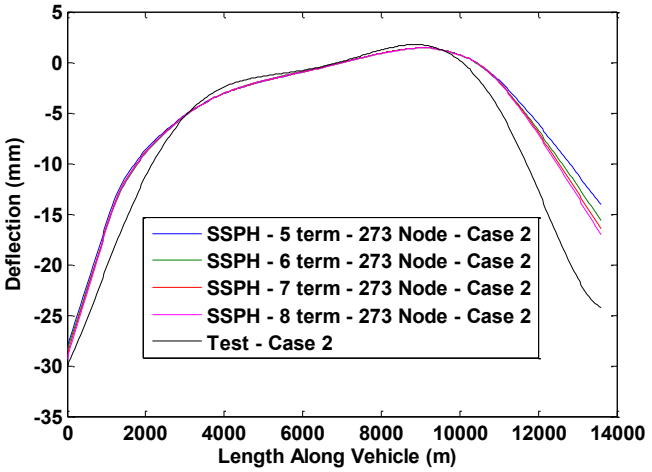

Fig. 9. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 273 nodes are used

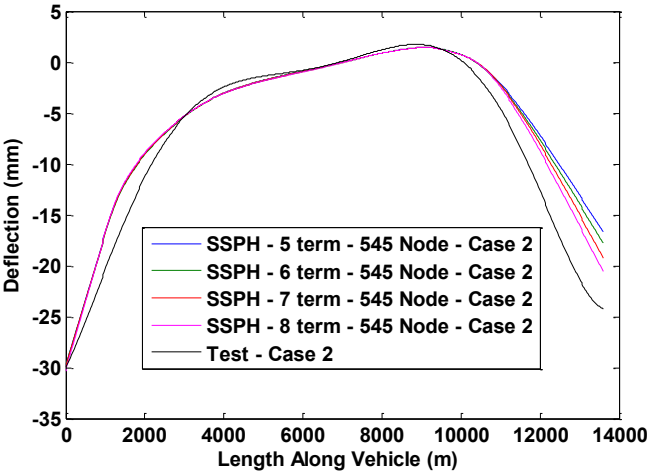

Fig. 10. Deflections along the x-axis computed by the SSPH method employing different number of terms in the TSEs and experimental results where 545 nodes are used

It is observed in Figures 8 to 10 that accuracy of the SSPH method increases as the number of nodes and terms in the TSEs is increased.

5. Conclusion

The deflections of a semi trailer chassis under various loading conditions are calculated based on 1D dimensional Euler Bernoulli beam. The 1D beam is modelled according to the CAD data and the moment of inertia function of the beam is defined by using polynomial function fitting. The numerical calculations are performed by using the SSPH method by employing different number of terms in the TSEs.

It is found that the simple 1D Euler Bernoulli beam modelled based on the 3D CAD data has enough details to obtain reasonable results by using numerical methods. So that during new product develeopment process it may be used to avoid the need of extra cost and time for repeating of FEM analysis. The SSPH method provides satisfactory results and convergence rate.

The first time the performance of the SSPH method for the fourth order non-homogeneous variable coefficents linear boundary value problems is evaluated. Moreover, it is found that the SSPH method is also useful for the solutions of the indeterminate beam problems. It is found that SSPH method yields more accurate results especially in the existence of eight terms in the TSEs. Classical Plate Theory and First Order Shear Deformation Theory which are not investigated in this paper will be the subject of future studies.

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Micro-Turbine Design, Production and Testing

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Abstract- Large scale utilization of electricity started at the end of 19th century with the construction first power plant and there phase current was introduced. Power plant technology evolved rapidly and electricity use has increased rapidly since then. Outbreak of energy crisis in 1970s and threat of the global warming has forced the people to search clean energy resources. Among the renewable energy sources, wind energy has become the most popular case. Development of the necessary technology for wind turbines reached a commercial competence In the 1990s. Turning to wind energy in Turkey began after 2006 and has shown a rapid increase until 2015. When considering the country's wind potential it tends to stay in rapid growth. In this study, 2 kW micro-turbines is designed, manufactured and tested by using local facility. The aim of this study is to design a micro-turbine for use in low wind speed area, create industrial infrastructure related to the production of micro-turbine, and develop different production technologies for local industry.

Keywords-Renewable energy, wind power, turbine design, aluminium wings.

1. Introduction

Use of wind energy is as old as humanity. Humanity first was used wind energy for floating vessels, grinding grain and irrigation. With the widespread use of electricity in the 20th century, new application area was born for wind power. With the energy crisis which began in 1973, searching alternative energy source has been started. Among the renewable energy sources, wind energy has become the most popular case. With this process research activities in the field of wind energy have continued to increase in the last 30 years. Development of the necessary technology for wind turbines reached a commercial competence in the 1990s. Commercial wind turbines have been started to establish since 1990 and have shown a rapid increase after 2004. Global installed capacity was around 1000 MW until 1990 but with the development of technology in this area, installed capacity doubled every three years after 1990 and total capacity increased to 60,000 MW in 2006 [1]. According to the International Energy Agency, over the past decade terrestrial wind power installation increased 27 % each year. While global setup until the end of 2000 was 18 GW, installation had been reached 238 GW in 2011 [2]. Countries, together with the increase global warming and energy cost, have accelerated growth in this area by providing significant support to the wind energy sector.

Turning to wind energy in Turkey began after 2006 and had shown a rapid increase until 2015 [1]. When considering the country's wind potential it tends to stay in its rapid growth. Installed wind power plant in Turkey had reached nearly 4,000 MW until 2015 while global installed capacity had exceeded 350 GW. When global energy demand and costs are considered, this increase is expected to continue faster.

Although small wind turbines remain in the shade of large wind turbines, they generate appreciable electricity [2]. Micro-turbines have several advantages over large-scale turbines. The registration fee or permission is not required to establish a micro-turbine. So in recent year's very quick increase have been seen in micro-turbine installation. For example, 3715 micro turbines (0-100kw) installation was

made in the UK only in 2012 [3]. Micro-turbines generally shows itself in areas where wind speeds are slow. A single turbine which scales to meet the individual needs of electricity produced from. But many small-scale turbines established in the same place, in this way production capacity was comparable to large scale turbines [4]. According to the studies, among the micro turbines, horizontal axis turbines were found to be more efficient to the vertical axis [5]. Some work based on with meteorological data, 300-1000W capacity micro-turbines were shown to meet the electricity needs of a house [6]. Micro-turbines have a wide range of uses in both rural areas and cities worldwide [7-8]. Multiple installations of micro-turbines can be integrated into the electrical grid. Emissions of greenhouse gases are reduced in this way by providing energy savings [9]. Micro-turbines are expected to have a large share of reducing greenhouse gas emissions. That's why the UK government provides incentives for the use of the micro-turbine technology [10]. 455.000- 600.000 micro turbines are estimated to be installed across the UK by 2020 [11].

In this study, a micro-turbine is designed and manufactured using local industry facilities by using aluminium and steel. The main reasons for the use of these materials are that these materials can be easily processed in local industry in all around the Turkey. Blades are made from aluminium sheets 3 mm in thickness. The blades are attached to the 3 mm in thickness and 120 mm diameter pipe with the aid of hinges. All components except the rotor blades are made of steel. 10 m tower with 260 mm diameter is made of 10 mm thick steel. Foundation was previously prepared so as to screw the tower into the ground. With the help of ship ladder there is the possibility to reach nacelle safely. The prototype design will be used for training so nacelle is mounted on a platform which looks like a balcony on the tower. Gearbox, low and high speed shaft and generator are attached in the nacelle. To put the electrical and other components 2x2x2 m in size a control room is designed and manufactured. For security of people turbine is surrounded 10 m diameter and 2 m height wire mesh.

2. Materials and methods

According to the power capacity, wind turbines are classified as large (> 1 MW), medium (40 kW-1 MW) and small scale. Power generating turbines range of 0.4-2.5 kW is called micro turbines. Small-scale wind turbine's maximum power coefficient (c_p) is between 0.2-0.35 [12].

The mechanical power output of the converter can be expressed with the equation (1):

$$P = \frac{1}{4}.A.\rho.(v_1^2 - v_2^2)(v_1 + v_2) \quad (1)$$

Where, A is blade cross section area, ρ is density of air; v_1 flow velocity in front of converter and v_2 is velocity behind the converter. The ratio between the mechanical power extracted by converter to power of airstream is defined as power coefficient (c_p) and expressed with the equation (2) [13]:

$$c_p = \frac{P}{P_0} = \frac{\frac{1}{4}.A.\rho.(v_1^2 - v_2^2)(v_1 + v_2)}{\frac{1}{2}.A.\rho v_1^3} \quad (2)$$

Where P_0 undisturbed air stream power and P is extracted mechanical power by converter. After some arrangement power coefficient can be expressed with the equation (3):

$$c_p = \frac{P}{P_0} = \frac{1}{2}\left[1 - \left(\frac{v_2}{v_1}\right)^2\right]\left[1 + \frac{v_2}{v_1}\right] \quad (3)$$

The power coefficient directly depends on the ratio of air velocities as shown in equation (3). With the speed ratio 1/3, the maximum power coefficient (c_p) can be obtained as 0.593. Betz was the first to derive this value, therefore frequently called the Betz factor. According to the some simplifications the maximum power generated at the turbine is calculated with the help of equation (4):

$$P = \frac{1}{2}.c_p A.\rho_a.v^3 \quad (4)$$

Max amount of power to be generated in a turbine is directly proportional to the third power of the wind speed, so setting up the wind turbines in places where high wind speeds is always more advantageous. Doubling the wind speed rises to eight times the amount of power produced. So large-scale wind turbines are installed at a place where the wind speed is high. However, low windy places where establishing micro turbines can be offered to individual use.

Momentum theory by Betz indicates theoretical maximum power limit. But in realty power coefficient depends on characteristics of energy converter. Aerodynamic lift and drag are the most effective on power therefore, utilization of aerodynamic lift increase the efficiency. The lift force is due to the difference in airflow speed (pressure difference) between the top and bottom of the blades. Aerodynamic forces acting on airfoil S822 is simulated and shown in Figure 1. This airfoil is used for small scale wind turbine blade production with the rotor diameter between 3 and 10 m. As shown in Figure 1 at the bottom of the airfoil there is high pressure but in the upper part of the airfoil comprises low pressure. The pressure difference between the top and bottom of airfoil creates a lift force in the upward direction.

In this study, the blades are made from aluminium sheets and pipes. Aluminium plate is cut into shape of the blades and screwed to aluminium pipe to form rotor. Blades design and the parameters are given in Figure 2. The blades are rotated to the wind speed direction with the angle of attack 30 degrees and fixed to the rotor hub. Mechanical energy is transmitted from rotor to low speed shaft which is connected to gear box. Rotation increased 8 times in gear box and mechanical energy transfer to high speed shaft which is connected to alternator to generate electricity. Working diagram of mechanical component is shown in Figure 3.

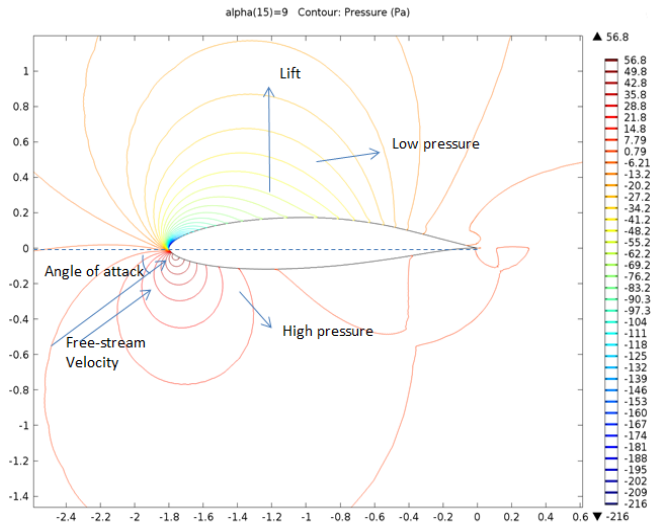

Fig. 1. Pressure contours for S822 airfoil at the angle of attack 9° and 10 m/s

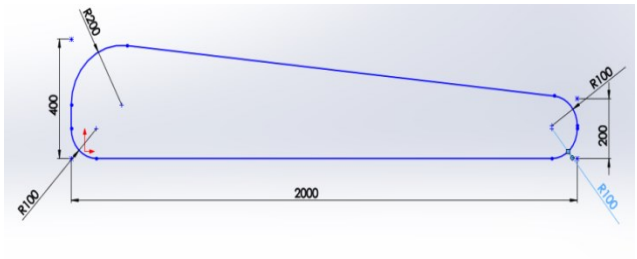

Fig. 2. CAD design of blades and parameters

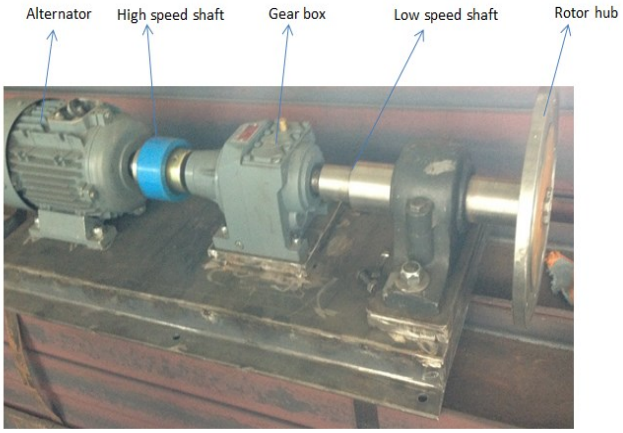

Fig. 3. Working diagram of the mechanical component

Setup diagram of the system is given in Figure 4. Generated electricity is transferred to the control unit before charging. The control unit makes the control of the battery charging and also used to stop the turbine when the battery is full. To use electricity when there is no wind it is stored in the battery. Two 150 A gel batteries are used to store 3.6 kWh in this test run.

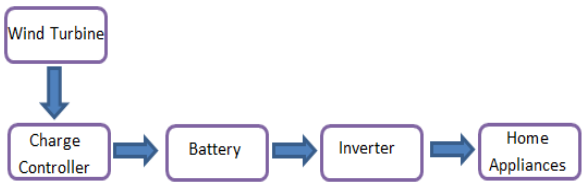

Fig. 4. Set up diagram of the system

In previous experimental studies indicates that micro-turbine power coefficient ranged between 0.2 and 0.35. Wind turbine is designed for a place for a low wind speed area therefore, blade diameter is larger than the power of the alternator. In this way, turbine is able to produce electricity at low wind speed. With respect to calculations, when the wind speed is 5 m/s it has production capacity of 0.5 kW. When the wind speed increased to 7 m/s, production capacity reaches 1.4 kW, finally with the speed of 9-10 m/s capacity becomes 100%.

3. Results and Discussion

Because Turkey is surrounded by sea on three sides and inner geographic differences make it rich in the presence of different climatic wind. Wind map is shown in Figure 5 and Marmara, Aegean, Black Sea and the Mediterranean region coast is comprised of high energy winds value. According to the wind speed distribution Turkey wind potential is presented in Table 1.

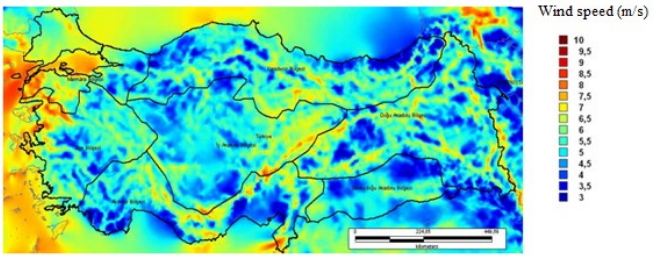

Fig. 5. Wind map of Turkey [14]

Table 1. Wind energy potential in Turkey [14]

Annual Average Wind Speed (m/s)	**Average Wind Power Density W/m^2**	**Total installable power (MW)**
7.0-7.5	400-500	29,259.36
7.5-8.0	500-600	12,994.32
8.0-9.0	600-800	5,399.92
>9.0	>800	195.84
Total		**47,849.00**

Total assessable wind energy potential is calculated as 47,849 MW around the Turkey for over 7 m/s. This is the economic potential for large wind turbines installation. Also total wind power potential is calculated as 83,900 MW for wind speed in the range of 6,5-7 m/s. This range is consistent

for small scale wind turbines. For this range Turkey has very high wind potential so micro-turbine installation is great importance for Turkey. Given that total installed power capacity of Turkey was 60,000 MW by 2014 84.000 MW is more than scale to meet the needs of potential of the country. Total electricity consumption in Turkey was 198,045,181 MWh and 22.7 % of it was consumed in the house in 2014. Any permit is not required for the installation of individual small scale wind turbines. If only spreading the use of small wind turbines for homes, large-scale contribution to the national economy can be provided. Because amount of electricity produced from natural gas constitute 43.6 % of the total production. Almost all of the natural gas consumed for generating electricity is imported. Another aspect, each passing day global warming reaches with threats in size and requires alternative solutions. By encouraging the use of small wind turbines in national and international level, remarkable scale carbon dioxide emissions can be reduced.

In this study, a micro-turbine is designed and manufactured using local industry facilities by using aluminum and steel. The main reasons for the use of these materials that these materials can be easily processed in local industry in all around the Turkey. Blades are made from aluminum sheets 3 mm in thickness. The blades are attached to the 3 mm in thickness and 120 mm diameter pipe with the aid of hinges. All components except the rotor blades are made of steel. 10 m tower with 260 mm diameter is made of 10 mm thick steel. Foundation was previously prepared so as to screw the tower into the ground. With the help of ship ladder there is the possibility to reach nacelle safely. The prototype design will be used for training so nacelle is mounted on a platform which looks like a balcony on the tower. Gearbox, low and high speed shaft and generator are attached in the nacelle. To put the electrical and other components 2x2x2 m in size a control room is designed and manufactured. For security of people turbine is surrounded 10 m diameter and 2 m height wire mesh.

Mechanical energy generated in the rotor is transferred to gearbox via low speed shaft. After rotation is increased eight times in gearbox, mechanical energy is transferred to the high-speed shaft. Generator is a 2 kW alternator type of machine that can generate electricity. When the speed of rotation reaches 200 rpm, power generation starts. Electricity produced in the generator is initially stored in two 200 A gel batteries. With the help of an inverter, electric current from the battery is converted to 220 V ac before use. When the battery is fully charged control unit stops the movement of rotor by stimulating the magnetic brake system in the generator. Likewise, when the wind blows very fast the magnetic brake system comes into play again. Yaw mechanism is controlled automatically by the wind. The materials used in this study are planned by considering the possibilities of the domestic industry. This wind turbine is designed and constructed for the places where wind speed is less than 7 m/s and complete design is shown in Figure 6. Wind turbine is builted in Adiyaman University Campus.

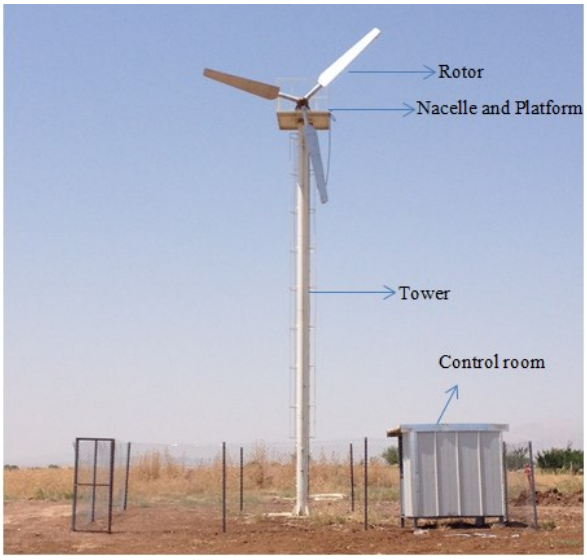

Fig. 6. Wind turbine

4. Conclusion

85% portion of the electrical energy produced today is derived from fossil fuels. Because of the limited oil, natural gas and coal reserves in the world and threat of global warming are mandatory to find alternative energy sources. In addition, energy prices in today world cost very high amount. Without the resources to produce its own energy, states are spending serious upheaval in financial terms. Use of fossil fuels is releasing greenhouse gases it is causing global warming. Reduction of greenhouse gases for a better world has now become a necessity. Wind energy has significant potential in this respect. Wind turbine technology has completed the necessary infrastructure for installation. Turkey has very high wind potential in the range between 6.5-7 m/s according to its consumption so making widespread of small-scale wind turbines are great importance. Domestic production of wind turbine should be supported. By encouraging small-scale wind turbines can increase the use of clean energy, could contribute the country's economy, gives opportunity to leave a cleaner country for the new generation, pay less money for energy import and can contribute to the economy by making domestic production. The way to turn off the energy sourced foreign trade deficit recover with the production of domestic resources with indigenous technology. Otherwise, the wind turbines bought from abroad is a serious cost

In this study 5m in diameter turbine rotor is designed and manufactured entirely using local facilities and materials. The blades are made of aluminium sheet and pipe, other parts of system are manufactured from steel. Control unit, gearbox, gel batteries, inverter and alternator are provided by the way of purchasing from the national manufacturer. This study has taken into consideration the infrastructure of the domestic industry.

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Education in Visual Communication Design Studies in the Age of Globalized Knowledge

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Abstract-The emergence of "the Global Information Society" has entailed Man's full acquisition of the necessary knowledge and skills so that Man, as the basis of civilization, could survive and withstand. Those who fall distant to the opportunities and the amenities provided by the latest developments in information technologies seem to be heading towards estrangement from the social flux as well as face possible difficulties to continue professional business life. The task of educating individuals who can effectively take part in "the Global Knowledge Society" is the responsibility of educational institutions among which universities come forth with their leading role in the process. The main goal of this paper is promoting consciousness regarding the rapid developments especially in the modern communications media and their cultural and economic effects as well as outlining a model that serves to make the necessary knowledge and skills possible in pursuit of success in the Information Age.

Keywords: Media in flux, systems, informatics, cybernetics.

1. Media in Flux

Because of the fact that it is the engineers who develop the new communication technologies, it has become quite difficult for the theoreticians to fully grasp the characteristics of these technologies. The emerging gap can only be bridged by specialists who are knowledgeable about technology, informed of sociological theories and skilled at using as well as creating new communication tools. This condition aggrandizes the role and responsibility of the outstanding communication schools of our time.

The Department of Visual Communication Design is built on the rapid change, which the modern communication tools, systems and institutions are put through in terms of dimensions and contents as well as the social ramifications that they cause. Apart from the changes in the areas of manufacturing, technology and commerce, the changes in the cultural and political spheres also enhance the functions of communication.

While the focus of discussions in communication studies was placed on the radio, TV, printed media and cinema until only a few decades ago, we are confronted today with the prevalence of the complicated, diversified and puzzling means of communication. Of these various new devices, the audio-visual multi-media seem to have the leading definitive role.

All these advances truly justify the reason our age is called "the Information Age" Beginning with the conventional post and telegram; the computer network, which extends almost everywhere, has brought about an "information society."

2. The Present Condition in Turkey

While sorting out many significant and astonishing processes, Information Technology creates a host of new problems, not only in the developing countries, but also in advanced countries as well. The problems in the advanced, affluent societies center around such issues as information garbage, security, excessive information flow, the isolation and the alienation of the individual, whereas the problems in developing countries indicate the additional aspects of dependency (in technology, economy, culture, politics and law) as well as the limitations over the imported technologies in terms of the way they should be functioning.

Just as seen in many developing countries, the socio-economical effects of the creative potentials, which the new communication and information technologies, offer have not been fully recognized and appreciated in Turkey as yet. The Department of Visual Communication Design, with its crucial task of training the individuals who would be able to grasp and use these technologies creatively, has only been recently ushered in the schools of communications/arts in Turkish universities. Besides, these undergraduate programs need to be supported through well-structured graduate programs.

3. The Significance of Visual Communications Design

The 20th Century has been an age of mass media and communication; it is difficult to surmise what kind of communication tool will prevail in the 21st Century. The future shock which we have yet to undergo due to how usual/conventional communication tools will turn into haunting residues of the past already confronts us with a vital question: How unready and defenseless are we vis-à-vis the changes in the field of communication? There are many scenarios and some of them are pretty scary [1].

All these made a serious impact on the existing fields of communications and arts:

The digital techniques in video and sound processing, including the non-linear digital editing, have increasingly been replacing the analog imaging and sound-recording methods as well as linear analog film editing. Cinematography is in an irrevocable process of merging with the digital visual effects and three-dimensional animations. The high-definition and internet-compatible digital television sets also make the TV screen an interactive media. Therefore, the syllabi, the methodology and the aesthetics instructed in departments of cinema and television need to be reconsidered dramatically.

In much the same way, the conventional press (printed media) is put through a revolutionizing process as the virtual and verbal high-tech models are ushered in, transferring the press into the cyberspace and the advertising sector on to the desktop [2]. As the fields of graphics, sculpture, industrial design and art gradually became electronically applied, the fine arts applications and aesthetics, too, became subject to profound changes.

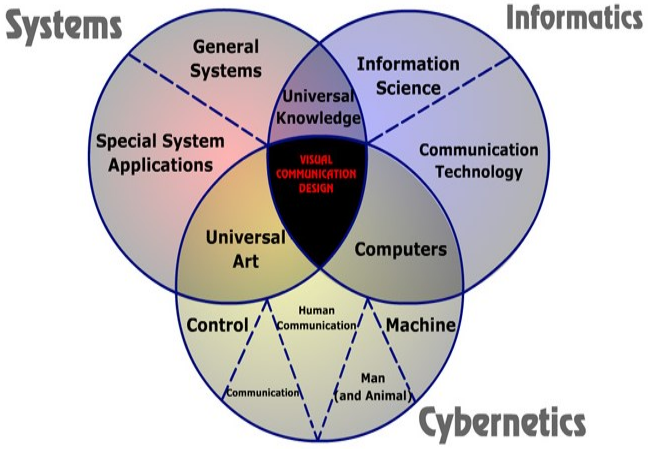
Three-dimensional modeling and simulation have been increasingly and intensively placed at the architects' and interior designers' disposal for their uses in designing.

Furthermore, it is an imperative to take into consideration that computer technology and its networks are gradually merging with communication tools. Today a single connection (i.e. a PC which is connected) to the net makes it possible for you to listen to the radio, watch the TV, follow the printed press, send and receive e-mails and even have televised meetings.

As a multi-disciplinary field, the Visual Communication Design integrates an all-encompassing syllabus that suits the latest visual forms and communicative technologies of media. While carrying out this syllabus, it makes possible for the students to soundly comprehend the swerving nature of the creative applications in these fields as well as gaining them a sense of how the future of arts and technology might be shaped. It is for this reason that the Department has more advantages than the conventional, established departments with the same or similar academic focus.

4. Systemology and Epistemology

The Department of Visual Communication Design has adopted the General Systems Approach as the common theoretical framework, which is based on a holistic method of reasoning. The sciences of system and knowledge offer a multidisciplinary and interdisciplinary perspective, incorporating elements from social sciences, behavioral sciences, engineering, physical sciences and cultural research. The subject in focus should be evaluated in harmony with the perspectives of informatics, cybernetics and the General Systems Approach, taking into consideration its technological, social, cultural, political, legal and economic aspects.



In today's multi-disciplinary perspective, Visual Communication Design is located in the intersection area of Systems, Informatics and Cybernetics. Prof. Dr. Emin Doğan Aydın
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5. Communication and Informatics

For any communication, a communication system is needed just as for any information exchange a system of information is required. A communication system consists of physical, electronic and social structures that provide and facilitate messaging between two or more people. A system of information, on the other hand, provides and facilitates messaging between two or more people as well as a person and another system of information or two by means of its physical, electronic and social structures.

Although information systems technology is similar to the communication system in many ways, they are different from each other in terms of the ways they are used: Information systems have been designed for interpersonal communication. Simply put, all the inputs and outputs are called "information" whereas the inward or outward movements of information are called information system manipulation.

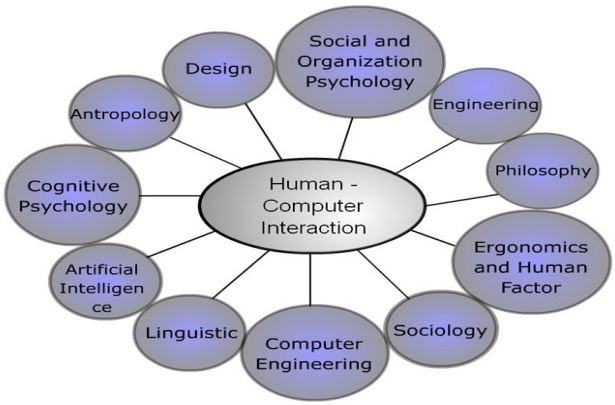
To prevent confusion, we should note that, when using a computer system there are basically two activities that take place named as input and output. The first one takes place on the data that remain apart from the system software, involving what could be qualified as "the manipulation" of the information system, and consisting of the processes conventionally recognized to be the information manipulation, data retrieval, creating database or data processing. The second one, the system navigation (the user interface) [3], involves the user's clicking a button and the system's responding to it, by which the user sends data (input) to the system.

Communications is wholly different from information manipulation. Yet, the increasing popularization of the electronic systems blurs this distinction. Complex

information systems either "interlocutor" with us or demand us to respond to them when we need assistance or data! These interactive human-machine processes replace many one-to-one human interactions of daily life.

Human-Computer Interaction is accepted as a multi-disciplinary application area, which is related to 11 basic disciplines.

- Computer Engineering
- Cognitive Psychology
- Social and Organizational Psychology
- Ergonomics and Human Factor
- Basic Engineering Sciences
- Design
- Anthropology
- Sociology
- Philosophy
- Linguistics
- Artificial Intelligence



Disciplines Related to Human Computer Interaction
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What's more, importantly, each single electronic communication tool necessitates exactly the same behavior the information systems require us to do. For instance, when we alter a web site, we navigate across the system and make changes in the data. All interactive media ranging from three-dimensional virtual simulations to web sites, from interactive video installations to interactive televisions are considered as systems of interaction. The most fruitful approach would then be accepting that each system of communication entails a manipulation of the information system [4]. The fact that the increase in the use of computer and computer networks in our time makes it an imperative to incorporate the science of information into all sorts of instruction in the schools of communication at universities.

The typical curricula and programs provided in the fine arts and communications departments in Turkey so far comprise cultural studies, media research and some courses borrowed from social sciences as well as some practical education accompanied by some limited equipments. Students often graduate without a proper practical knowledge and grasp of the technology and the information systems, which they would have to use in the designs demanded by the market. Then, the expertise required for the professional carriers are meant to be completed or made up for outside of the university, at extra-curricular workshops and seminars, or through internships at various media, news agencies, radio and TV institutions as well as the advertisement agencies. Such being the case, the school time is split into two. Most of our students start preferring to work in the market to studying at school and take their midterms and finals.

In the 2002-2003 academic year, (Visual) Communication Design undergraduate program was opened as a part of the Faculty of Communication, to train individuals on computer aided "Visual Communication Design" technology, which has gained a widespread application area after the 1990s. Admission to this program is through proficiency test and it is one of the most distinguished undergraduate programs of our country, as it consists of intensively computer aided courses on multi-disciplinary "Visual Communication Design" subjects.

The power of information technology makes itself felt particularly at media education and can be explained as in the below:

1. Computer technologies help to save time in writing, drawing, image processing, redaction and layout considerably.
2. The facilities provided by high-tech pull the costs down since all the newspaper and TV procedures can be coped with in a single room.
3. The facilities provided by the web, as in web publishing, pull down the higher costs of duplication and distribution by simply dispensing with them.
4. www and e-mail database facilitate access to sources of information.

Since this undergraduate program on "Visual Communication Design" is very new, there are very few specialists for instruction and researching in this field. For this reason, to have continuity in education and bring up specialists who will make researches and work in "Visual Communication Design" field, it is necessary to open a graduate program in this field.

Main objective of Visual Communication Design Department's graduate program is to bring up researchers on Visual Communication Design in the following fields:

1. Analysis (User Reaction Tests, Usability Measurement)
2. Design (Interactive Media, Interactive Object, Interactive Space Design)
3. Programming (Software Development for Interactive Media)

The intenetion of the program is to find out what kind of a mechanism and system is necessary for Humans to get their expectations from the Computer

- Accurately
- Easily
- Effectively

The first computer was so heavy that it was impossible to carry; it was very expensive and had a very impractical structure when it started to be commercially sold in 1950s. In 1970s, the first personal computer was developed with better technical means and it was relatively cheaper than the first one. Now as a result of the silicon chip technology, computers have entered into every aspect of our daily lives. Personal use of computer provided new application fields for the computer in various occupational areas from education to trade, defense industry to entertainment.

For computer applications to be accepted by a wide range of users and computers to be used effectively, the interface, which enables the interaction between the computer and the user, should be very perfectly designed.

The specialization area that studies interface design was called HCI, derived from the first letters of Human Computer Interface/Interaction.

The concept of user interface appeared at the beginning of 1970s and it was also named as Man-Machine Interface (MMI). Human-Computer Interaction or Man-Machine

Interface deals with principles of design that plays an important role in the agronomical designation of the computer, screen, mouse and keyboard and is not limited with the design of interfaces on the computer screen.

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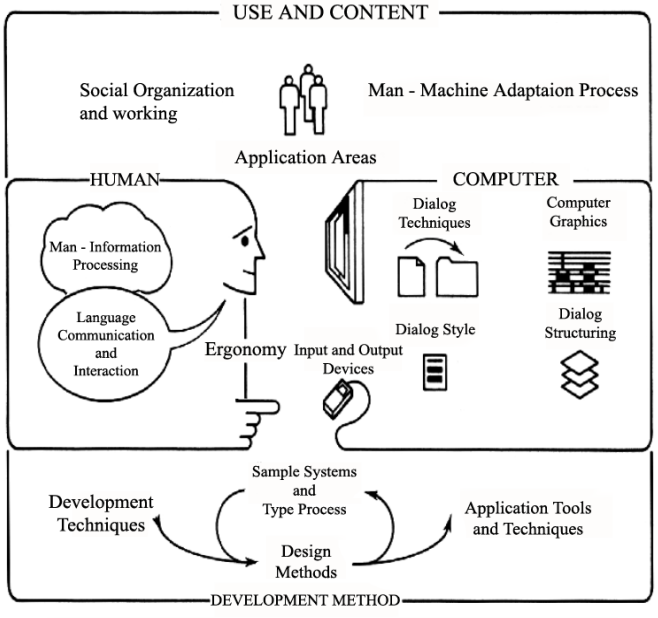
The main goals of this graduate program are cited below [5-6]:



Basics of Human - Computer Interactivity 1996 Jenny Preece

- To offer graduates who are well informed about global developments in a variety of arts and communications technology and who have a strong creative incentive backed with a complete theoretical background.
- To inform the participants about the theories of arts, aesthetics, visual culture, informatics, general systems and cybernetic methods, and to instruct them about the rapid changes and the impacts of communications with regard to technology, dimension and content, within the framework of deduction theories.
- To give a notion of the social, cultural and economical implications of any creative activity and its relation to the existing body of universal art in order to give the student a wide perspective over their own work
- To instruct about the planning, functioning, processing and structure of information and communication systems. To teach the appropriate manners of utilization to come up with the best possible design options.
- To instruct about the social and economic utilization of the general system, structures and data-sources, communication systems /organizations / vehicles / channels and networks in society.
- To teach the terms and concepts about the information systems and the description of the databases and databanks which are permanently accumulated and updated in a large scale; and to scrutinize over their application areas and utilization in the functioning of informatics.
- To study various research and innovation projects in order to find solutions to the different application fields and practical informatics functions in an independent and critical approach; and to supply expertise on system analysis and synthesis.
- To supply information, related to the planning, innovation, application and integration of the international applications and practicing of information sciences.
- To obtain the understanding of the problems and efforts related to the security and completion of the information sciences /networks / and data.
- To evaluate and find out solutions about one dimensional information flow, and technological, cultural, political and legal dependency in the world.
- To supply information about the technological transfer from the point of view of functional signs its choice and application.

As costs increase in media sector continuously, the people in the sector face the need to catch up with the advances in step with the technology so as to have their legs to stand on in a highly competitive environment where the TV-watchers needs keep changing [7]. This condition makes a new personal profile necessary, one who can use a broad variety and selection of technological media instruments with their hybrid skills.

In view of the above, it is needless to say that universities and schools of communication are responsible for, and thus, ought to enterprise in the required software and hardware for the information support to be provided for their departments.

This simplified yet clear expression of a need emphasizes the significant role of technology, information support and their good applications in terms of bridging the yawning gap between the developing countries and the affluent societies in "the global village", taking into consideration the socio-economic elements and variables. The rational use of new technologies in education encourages the students for doing exciting work and opening new windows to the possibilities of furthering and expanding the field.

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Guide for Authors

The ***International Journal of Engineering Technologies*** **(IJET)** seeks to promote and disseminate knowledge of the various topics of engineering technologies. The journal aims to present to the international community important results of work in the fields of engineering such as imagining, researching, planning, creating, testing, improving, implementing, using and asking. The journal also aims to help researchers, scientists, manufacturers, institutions, world agencies, societies, etc. to keep up with new developments in theory and applications and to provide alternative engineering solutions to current.

The *International Journal of Engineering Technologies* is a quarterly published journal and operates an online submission and peer review system allowing authors to submit articles online and track their progress via its web interface. The journal aims for a publication speed of **60 days** from submission until final publication.

The coverage of IJET includes the following engineering areas, but not limited to:

All filed of engineering such as;

Chemical engineering

- Biomolecular engineering
- Materials engineering
- Molecular engineering
- Process engineering

Civil engineering

- Environmental engineering
- Geotechnical engineering
- Structural engineering
- Transport engineering
- Water resources engineering

Electrical engineering

- Computer engineering
- Electronic engineering
- Optical engineering
- Power engineering

Mechanical engineering

- Acoustical engineering

- Manufacturing engineering
- Thermal engineering
- Vehicle engineering

Systems (interdisciplinary) engineering

- Aerospace engineering
- Agricultural engineering
- Applied engineering
- Biological engineering
- Building services engineering
- Energy engineering
- Railway engineering
- Industrial engineering
- Mechatronics
- Military engineering
- Nano engineering
- Nuclear engineering
- Petroleum engineering

Types of Articles submitted should be original research papers, not previously published, in one of the following categories,

- Applicational and design studies.
- Technology development,

– Comparative case studies.

– Reviews of special topics.

– Reviews of work in progress and facilities development.

– Survey articles.

– Guest editorials for special issues.

Ethic Responsibilities

The publication of an article in peer-reviewed *"International Journal of Engineering Technologies"* is an essential building block in the development of a coherent and respected network of knowledge. It is a direct reflection of the quality of the work. Peer-reviewed articles support and embody the scientific method. It is therefore important to agree upon standards of expected ethical behavior for all parties involved in the act of publishing: the author, the journal editor, the peer reviewer, the publisher and the society of society-owned or sponsored journals.

All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, their work.

Submission of an article implies that the work described has not been published previously that it is not under consideration for publication elsewhere. The submission should be approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

Upon acceptance of an article, authors will be asked to complete a "Copyright Form". Acceptance of the agreement will ensure the widest possible dissemination of information. An e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a "Copyright Form" form or a link to the online version of this agreement.

Author Rights

As a journal author, you retain rights for a large number of author uses, including use by your employing institute or company. These rights are retained and permitted without the need to obtain specific permission from *IJET*. These include:

- The right to make copies (print or electronic) of the journal article for your own personal use, including for your own classroom teaching use;
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- the right to post a revised personal version of the text of the final journal article on your personal or institutional web site or server for scholarly purposes
- The right to use the journal article or any part thereof in a printed compilation of your works, such as collected writings or lecture notes.

Article Style

Authors must strictly follow the guide for authors, or their articles may be rejected without review. Editors reserve the right to adjust the style to certain standards of uniformity. Follow Title, Authors, Affiliations, Abstract, Keywords, Introduction, Materials and Methods, Theory/Calculation, Conclusions, Acknowledgements, References order when typing articles. The corresponding author should be identified with an asterisk and footnote. Collate acknowledgements in a separate section at the end of the article and do not include them on the title page, as a footnote to the title or otherwise.

Abstract and Keywords:

Enter an abstract of up to 250 words for all articles. This is a concise summary of the whole paper, not just the conclusions, and is understandable without reference to the rest of the paper. It should contain no citation to other published work. Include up to six keywords that describe your paper for indexing purposes.

Abbreviations and Acronyms:

Define abbreviations and acronyms the first time they are used in the text, even if they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title unless they are unavoidable.

Text Layout for Peer Review:

Use single column layout, double spacing and wide (3 cm) margins on white paper at the peer review stage. Ensure that each new paragraph is clearly indicated. Present tables and figure legends in the text where they are related and cited. Number all pages consecutively; use 12 pt font size and standard fonts; Times New Roman, Helvetica, or Courier is preferred.

Research Papers should not exceed 12 printed pages in two-column publishing format, including figures and tables.

Technical Notes and *Letters* should not exceed 2,000 words.

Reviews should not exceed 20 printed pages in two-column publishing format, including figures and tables.

Equations:

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). To make equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use an dash (–) rather than a hyphen for a minus sign. Use parentheses to avoid ambiguities in denominators. Punctuate equations with commas or periods when they are part of a sentence, as in

$$C = a + b \qquad (1)$$

Symbols in your equation should be defined before the equation appears or immediately following. Use “Eq. (1)” or “equation (1),” while citing.

Figures and Tables:

All illustrations must be supplied at the correct resolution:

* Black and white and colour photos - 300 dpi

* Graphs, drawings, etc - 800 dpi preferred; 600 dpi minimum

* Combinations of photos and drawings (black and white and color) - 500 dpi

In addition to using figures in the text, upload each figure as a separate file in either .tiff or .eps format during submission, with the figure number.

Table captions should be written in the same format as figure captions; for example, “Table 1. Appearance styles.”. Tables should be referenced in the text unabbreviated as “Table 1.”

References:

Please ensure that every reference cited in the text is also present in the reference list (and viceversa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. Citation of a reference as “in press” implies that the item has been accepted for publication. Number citations consecutively in square brackets [1]. Punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]. Use “Ref. [3]” or Reference [3]” at the beginning of a sentence: “Reference [3] was …”. Give all authors’ names; use “et al.” if there are six authors or more. For papers published in translated journals, first give the English citation, then the original foreign-language citation.

Books

[1] J. Clerk Maxwell*, A Treatise on Electricity and Magnetism,* 3rd ed., vol. 2. Oxford:Clarendon Press, 1892, pp.68-73.

Journals

[2] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface”, *IEEE Transl. J. Magn. Japan*, vol. 2, pp. 740-741, August 1987.

Conferences

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Reports

[4] IEEE Standard 519-1992, Recommended practices and requirements for harmonic control in electrical power systems, *The Institute of Electrical and Electronics Engineers*, 1993.

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A4 page margins should be margins: top = 24 mm, bottom = 24 mm, side = 15 mm. Main text should be given in two column. The column width is 87mm (3.425 in). The space between the two columns is 6 mm (0.236 in). Paragraph indentation is 3.5 mm (0.137 in). Follow the type sizes specified in Table. Position figures and tables at the tops and bottoms of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be centred below the figures; table captions should be centred above. Avoid placing figures and tables before their first mention in the text. Use the abbreviation "Fig. 1," even at the beginning of a sentence.

Type size (pts.)	Appearance		
	Regular	**Bold**	*Italic*
10	Authors' affiliations, Section titles, references, tables, table names, first letters in table captions,figure captions, footnotes, text subscripts, and superscripts	**Abstract**	
12	Main text, equations, Authors' names, [a]		*Subheading (1.1.)*
24	Paper title		

Submission checklist:

It is hoped that this list will be useful during the final checking of an article prior to sending it to the journal's Editor for review. Please consult this Guide for Authors for further details of any item. Ensure that the following items are present:

- ❖ One Author designated as corresponding Author:

• E-mail address

• Full postal address

• Telephone and fax numbers

- ❖ All necessary files have been uploaded

• Keywords: a minimum of 4

• All figure captions (supplied in a separate document)

• All tables (including title, description, footnotes, supplied in a separate document)

- ❖ Further considerations

• Manuscript has been "spellchecked" and "grammar-checked"

• References are in the correct format for this journal

• All references mentioned in the Reference list are cited in the text, and vice versa

• Permission has been obtained for use of copyrighted material from other sources (including the Web)

• Color figures are clearly marked as being intended for color reproduction on the Web (free of charge) and in print or to be reproduced in color on the Web (free of charge) and in black-and-white in print.

Article Template Containing Author Guidelines for Peer-Review

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**Department of Second Author, Faculty of First Author, Affiliation of First Author, Postal address

***Department of Third Author, Faculty of First Author, Affiliation of First Author, Postal address

(First Author Mail Address, Second Author Mail Address, Third Author Mail Address)

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Abstract- Enter an abstract of up to 250 words for all articles. This is a concise summary of the whole paper, not just the conclusions, and is understandable without reference to the rest of the paper. It should contain no citation to other published work. Include up to six keywords that describe your paper for indexing purposes. Define abbreviations and acronyms the first time they are used in the text, even if they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title unless they are unavoidable.

Keywords- Keyword1; keyword2; keyword3; keyword4; keyword5.

2. Introduction

Authors should any word processing software that is capable to make corrections on misspelled words and grammar structure according to American or Native English. Authors may get help by from word

processor by making appeared the paragraph marks and other hidden formatting symbols. This sample article is prepared to assist authors preparing their articles to IJET.

Indent level of paragraphs should be 0.63 cm (0.24 in) in the text of article. Use single column layout, double-spacing and wide (3 cm) margins on white paper at the peer review stage. Ensure that each new paragraph is clearly indicated. Present tables and figure legends in the text where they are related and cited. Number all pages consecutively; use 12 pt font size and standard fonts; Times New Roman, Helvetica, or Courier is preferred. Indicate references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given. Example: "..... as demonstrated [3, 6]. Barnaby and Jones [8] obtained a different result ...."

IJET accepts submissions in three styles that are defined as Research Papers, Technical Notes and Letter, and Review paper. The requirements of paper are as listed below:

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- Technical Notes and Letters should not exceed 2,000 words.
- Reviews should not exceed 20 printed pages in two-column publishing format, including figures and tables.

Authors are requested write equations using either any mathematical equation object inserted to word processor or using independent equation software. Symbols in your equation should be defined before the equation appears or immediately following. Use “Eq. (1)” or “equation (1),” while citing. Number equations consecutively with equation numbers in parentheses flush with the right margin, as in Eq. (1). To make equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use an dash (–) rather than a hyphen for a minus sign. Use parentheses to avoid ambiguities in denominators. Punctuate equations with commas or periods when they are part of a sentence, as in

$$C = a + b \qquad (1)$$

Section titles should be written in bold style while sub section titles are italic.

3. Figures and Tables

3.1. Figure Properties

All illustrations must be supplied at the correct resolution:

- Black and white and colour photos - 300 dpi
- Graphs, drawings, etc - 800 dpi preferred; 600 dpi minimum
- Combinations of photos and drawings (black and white and colour) - 500 dpi

In addition to using figures in the text, Authors are requested to upload each figure as a separate file in either .tiff or .eps format during submission, with the figure number as Fig.1., Fig.2a and so on. Figures are cited as “Fig.1” in sentences or as “Figure 1” at the beginning of sentence and paragraphs. Explanations related to figures should be given before figure. Figures and tables should be located at the top or bottom side of paper as done in accepted article format.

Figure 1. Engineering technologies.

Table captions should be written in the same format as figure captions; for example, “Table 1. Appearance styles.”. Tables should be referenced in the text unabbreviated as “Table 1.”

Table 1. Appearance properties of accepted manuscripts

Type size (pts.)	Appearance		
	Regular	**Bold**	*Italic*
10	Authors’ affiliations, Abstract, keywords, references, tables, table names, figure captions, footnotes, text subscripts, and superscripts	**Abstract**	
12	Main text, equations, Authors’ names, Section titles		*Subheading (1.1.)*
24	Paper title		

4. Submission Process

The *International Journal of Engineering Technologies* operates an online submission and peer review system that allows authors to submit articles online and track their progress via a web interface. Articles that are prepared referring to this template should be controlled according to submission checklist given in “Guide f Authors”. Editor handles submitted articles to IJET primarily in order to control in terms of compatibility to aims and scope of Journal.

Articles passed this control are checked for grammatical and template structures. If article passes this control too, then reviewers are assigned to article and Editor gives a reference number to paper. Authors registered to online submission system can track all these phases.

Editor also informs authors about processes of submitted article by e-mail. Each author may also apply to Editor via online submission system to review papers related to their study areas. Peer review is a critical element of publication, and one of the major cornerstones of the scientific process. Peer Review serves two key functions:

- Acts as a filter: Ensures research is properly verified before being published
- Improves the quality of the research

5. Conclusion

The conclusion section should emphasize the main contribution of the article to literature. Authors may also explain why the work is important, what are the novelties or possible applications and extensions. Do not replicate the abstract or sentences given in main text as the conclusion.

Acknowledgements

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- Acts as a filter: Ensures research is properly verified before being published
- Improves the quality of the research

8. Conclusion

The conclusion section should emphasize the main contribution of the article to literature. Authors may also explain why the work is important, what are the novelties or possible applications and extensions. Do not replicate the abstract or sentences given in main text as the conclusion.

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[12] IEEE Standard 519-1992, Recommended practices and requirements for harmonic control in electrical power systems, The Institute of Electrical and Electronics Engineers, 1993. (Standards and Reports)

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