American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-8, Issue-4, pp-274-284
www.ajer.org
Research Paper Open Access

# Improvement of Effect ignition Coil on Ignition System of Internal Combustion Engine Performance

Ahmed I. Jaber Alzubaydy, Zuhair S. Al-Sagar1, Proff Dr. Lutfi Y. Zedan3, Raed Anam Gaib , Sabbar Otaiwi Haddad

*Saint Petersburg Electrotechnical University "LETI"/ University of Diyala, College of engineering, Electrical power and machines*
*Baqubah Technical Institute, Middle Technical University, Baghdad, Electrical Dept.*
*University of Dayala, College of engineering, mechanical eng.*
*University of Tromso UiT .college of engineering , electrical power engineering Tromso UiT , Norway*
*Baqubah Technical Institute, Middle Technical University, Baghdad, Electrical Dept.*
*University of Dayala, College of engineering, mechanical eng.*
*Corresponding Author; Ahmed I. Jaber Alzubaydy*

***ABSTRACT:*** An internal combustion engine has a high role in a low power generation and a efficiency applications. One of the best methods. .The internal combustion engine with spark ignition can be controlled by electrical and electronic systems . The paper descrribtion and improvement of the batter engine performance and reduce the exhaust emission in engine is by using increase the number of winding of coil and new aprouch power electronics sysrem (full wave rectifier mosfet control for combusation system .This study shows coil charactarisctic and all electrical relation bteewn them (Number of turn, induced emf , maximum current , power losses magnatic flux in primary and secondary parls Data collection system Improved using Matlab software package

***KEYWORDS:*** engine coil primary and secoundary **, ignition system,** voltage**,** power Losses

---

Date of Submission:02-04-2019 Date of acceptance: 18-04-2019

---

## I. INTRODUCTION

Internal combustion engine being a complex technical the system includes a number of systems, one of which is the system this ignitions. Efficiency and quality of the engine ignition system it is ensured that the parameters of the spark discharge required for the moment parameters for successful ignition and fuel-air mixtures in cylinder.

Ignition system can be generated spark between the electrodes plug.The Spark level includes two phases: breakdown of the interelectrode gap of the spark plug and the capacitive phase of the discharge.

The effitincy ans speed of ingine depending from spark and combustion engines used spark ignition system, this system converts is low .

The most important moment in operation of the vichal the start of the engine.

The parts of the electrical circuit of the vehicle, component of the ignition system. Positive polarity voltage from the battery through the fuse goes to the ignition contacts and ignition relays (switch) to primary of coil When the switch open cicuit from the ignition of all of the contacts in the ignition input, and the voltage at the ignition system is not available. If the switch inserted in ignition lock and turn it clockwise by one sector contacts in the ignition and voltage close to the ignition connected to primary winding , the current flows on winding creates a magnetic field which will attract anchor the relay.

If switch contacts close, supply voltage to the low-voltage winding (primary) of the ignition coils and through it to the collector of the contact breaker switch. Hence the enduced emf to generate very high in secondary winding . The magnitude of the voltage will depend on the ratio of the number of turns in the coils (primary and secondary )/

For reliable operation of the engine, the ignition system must generate a high voltage with a higer than of 25 kV. The voltage at which the breakdown occurs between 14-17 kV. Thus, a high voltage reserve of about

7. When the engine is running, through the work of the generator voltage from 14.1 ± 0.2 in the primary winding of the ignition coil.the ignition system construction shown in figure (1) . Contact ignition system has several disadvantages. The largest of them burning the contacts for which of the primary winding of the current reel. For this reason, contact ignition system has a secondary voltage limit. In addition, with the increasing number of revolutions occurs secondary voltage reduction, because dropping time of the closed contact status.
Ignition coil Voltages for resonant converter based ignition system behaviour current and high voltage spark in secondary part of coil shown in figure (2) [18] .this figure represented modern ignition sysrem using power electronics control (full converter ).In this paper converter is used to produce the required. Simulation of capacitor discharge ignition system and resonant converter based ignition system are carried out in MATLAB and their performance is compared.

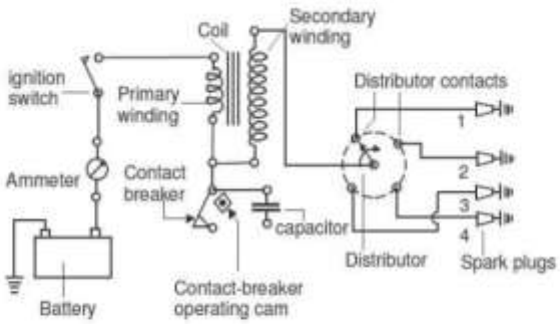



**Figure 1** ignition system construction

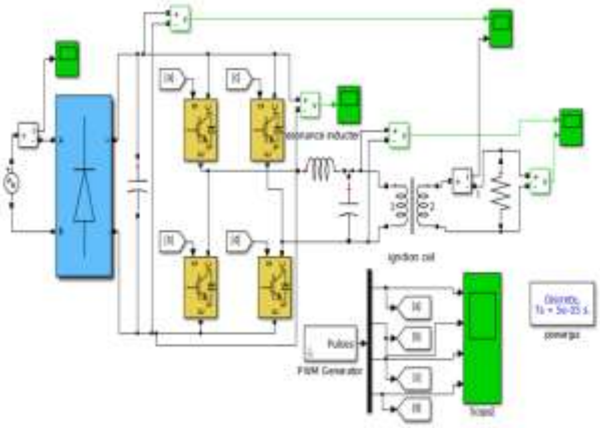


**Figure 2** model ignition system by Matlab

## II. CALCUALTION OF ELECTRICICAL COIL

From the equation (1) and (2) can be gate the electrical charactaristics of electrical coil (transformerLow Where E Induced emf, N Number of turns in the coil, I Maximum current in the coil , $\zeta_0$ =The permeability of the free space $4\pi \times 10^{-7}$ $\zeta_r$ =relative permeability $\zeta$ =length of elongation and A= cross section area

$$e= \frac{N^2 I \xi_0 \zeta_r A}{\zeta} \cdot \frac{d}{dt} \qquad (1)$$

$$\text{Magnetic Flux } \varphi = \frac{NI \xi_0 \zeta_r A}{d} \qquad (2)$$

V1/V2=N1/N2
When V2=E2 emf in secondary winding
d= diameter of the coil ,the result of the calculation shown in table 1 below

| No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| N1 | 200 | 300 | 400 | 600 |
| 2N | 11000 | 12000 | 14000 | 21000 |
| I/A | 0.3 | 0.6 | 0.9 | 1.2 |
| e1/V | 10.048 | 67.82 | 282 | 542 |
| e2/V | 502.4 | 2712 | 9034 | 18066 |
| $\varphi$ 1(web) | 1.0048 | 4.52*10- | 0.0113 | 0.018 |
| Lp1(W) | 2.0096 | 40.2492 | 253.8 | 650.4 |
| lp 2(W) | 100440.8 | 1627.2 | 8130.6 | 18427323 |
| $\varphi$ 2(W) | 0.0502 | 0.1808 | 0.3617 | 0.6028 |

## III. SIMULATION RESULT

The advantages of internal combustion systems depend on the voltage generated in secondary parts of coil .this makes the engines more efficient and faster speed .In this model ,The ignition system has advantages over the inductive discharge type system such as better performance at higher engine speed. by using Matlab design (code). The Figure 3 show the relation between input and output voltage in coil turn with time EMF 10Kv this EMF at normal combusation ignition [18].

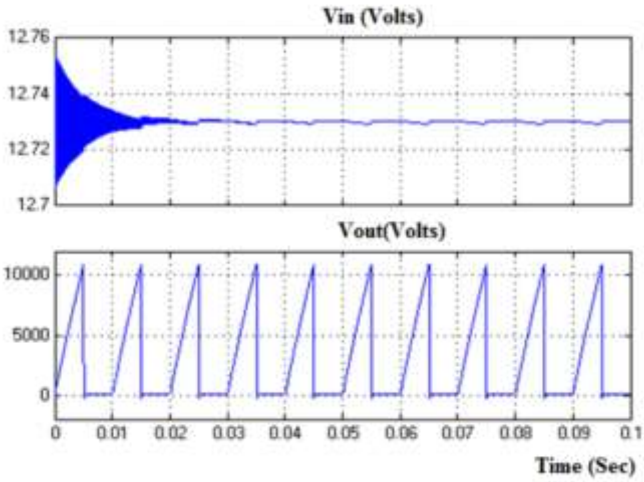



**Figure (3)** Input voltage and output voltage of system

**Figure 4**

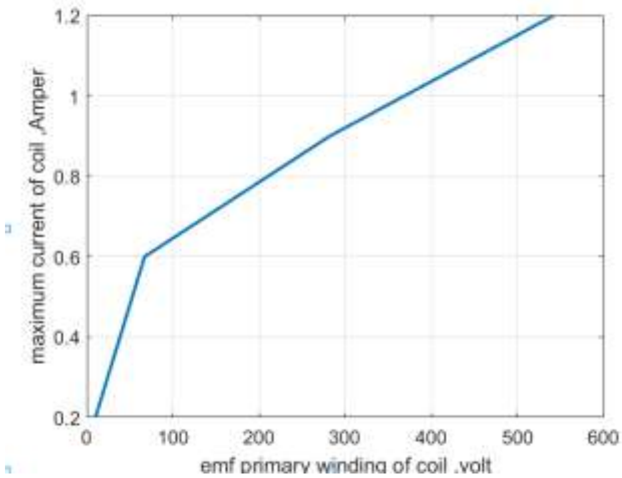



**Figure (4)** relation between maximum current and primary voltage

The relation between max current and EMF in primary coil of ignition system show that increase the current will leading to increase the Emf Voltage as liner combination Figure 4

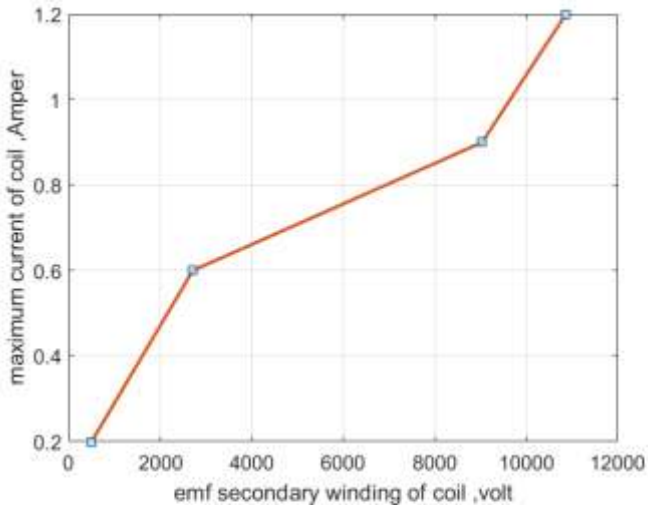



**Figure (5)** relation between maximum current and voltage in secoundary part

The relation between max current and EMF in secondary coil of ignition system with Kv show that increase the number of turen of secondary coil leading to get highr voltage in each turn on termail of seconadray coil whell each tnumber of turen leading incrasse current (Am) in primary coil.

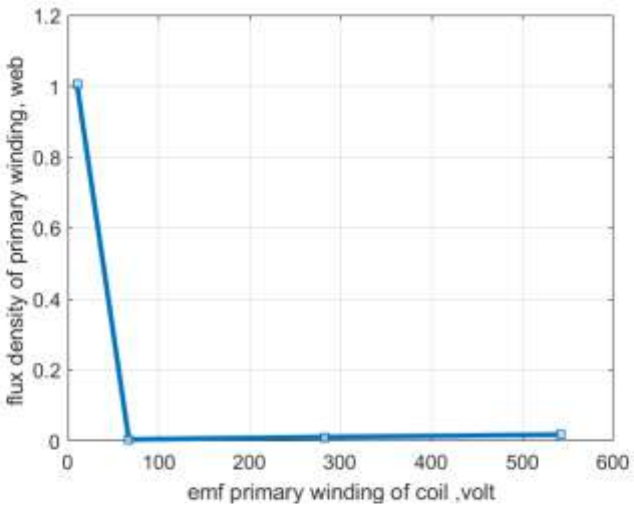



**Figure (6)** relation between flux and emf in primary winding

The induce fluxe in secondary winding is highr than of primary flux coil as faraday law because the nuber of tune in secondary widing is higher than number of turn in primary as in Figure 6

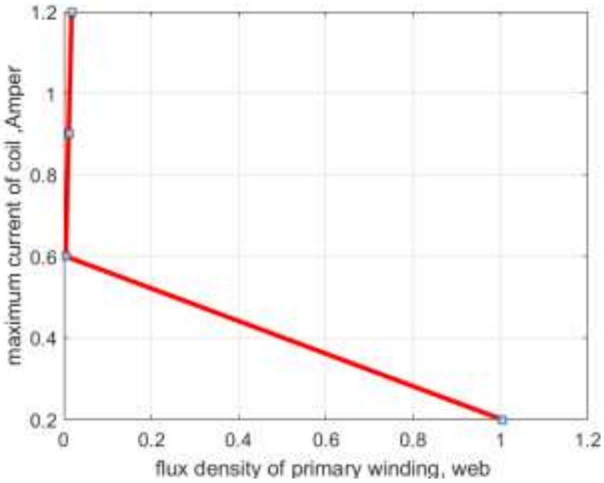



**Figure (7**) maximum current and magnatic flux in primary winding

Relation between flux and current in primary winding the changing in induces flux of primary current coil hase proportional relation as in Figure 7. Linear relation between the max current and magnatic flux figure 8

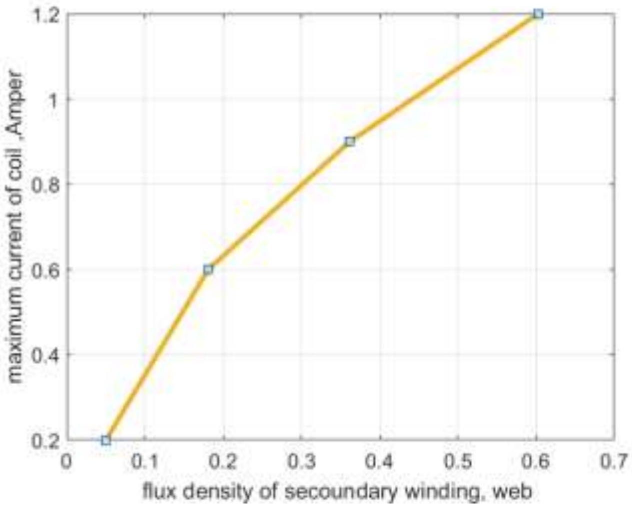



**Figure (8**) relation maximum current and magnatic flux in secondary winding

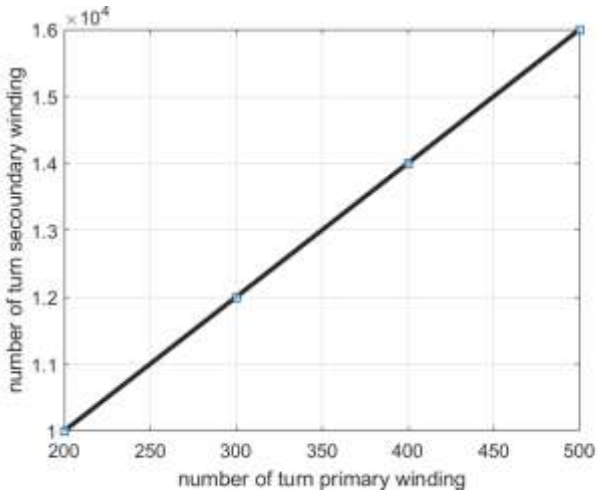



**Figure (9)** relation between number of turn in primary and secondary

Figure 9 ,10 and 11 shows the ratio between primary and secondary winding equal 30% in ignation system and relation between max current and number of winding in primary and secondary winding in coil of ignition system .figures 12 ,13 represented the relation curves between flux magnetics with number of turne in primary and secondary coil when the increase the numbers of turns the flux will be increase .

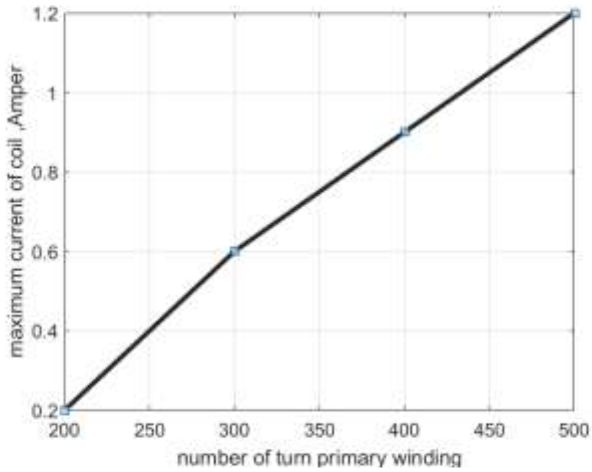



**Figure (10**) relation between Maximum current and number of turn in primary

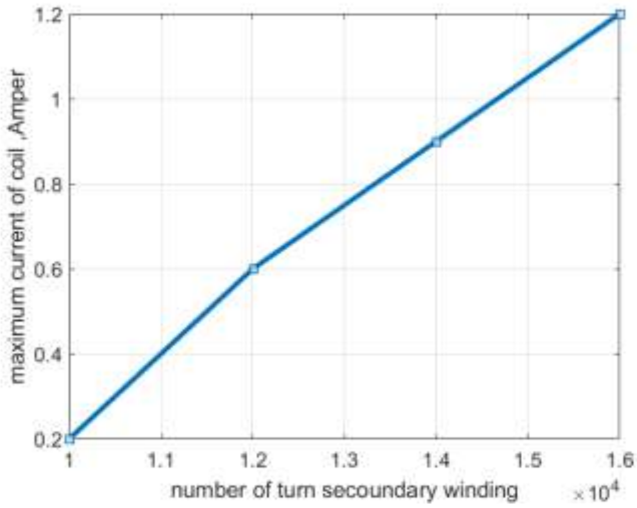



**Figure (11**) relation between Maximum current and number of turn in secondary

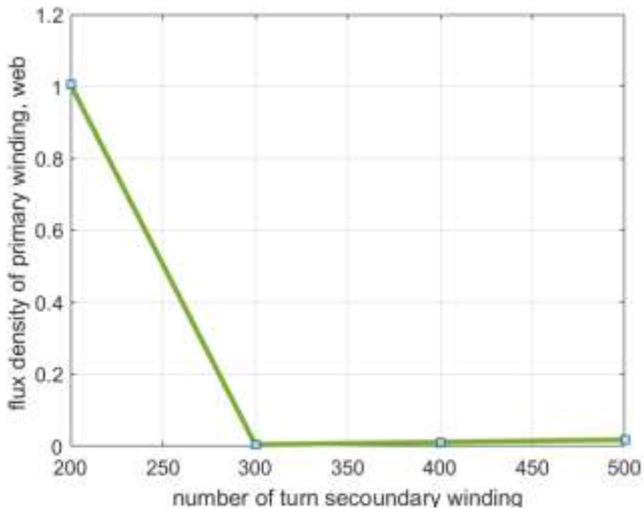



**Figure (12)** relation between magnatic flux and number of turn in primary

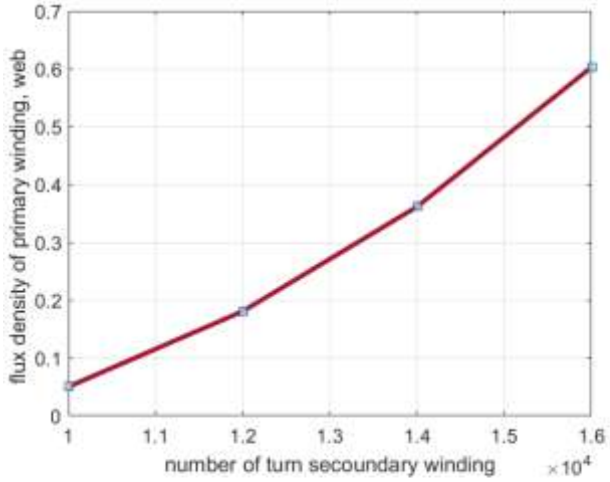



**Figure (13)** relation between magnatic flux and number of turn in secoundary

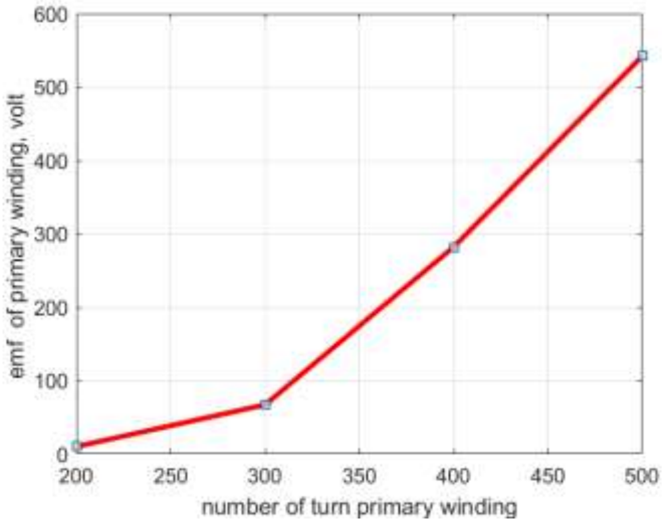



**Figure (14**) relation between EMF and number of turn in primary

Figures 14 and 15 shows the relations between EMF and number of turns in primary and secondary part coil

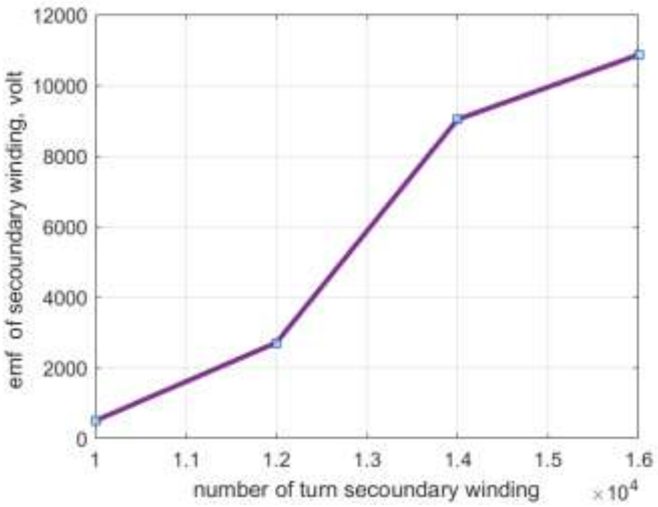



**Figure (15)** relation between emf and number of turn in secondary

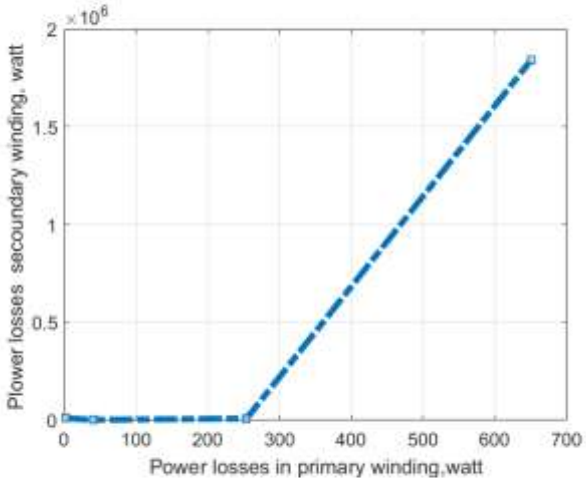



**Figure (16)** relation between power losses primary and power losses in secondary of coil

Figure 16 show the relation between power losses in primary and secondary

Figures 17.18 showing power losses with max current in primary and secondary winding for ignition coil

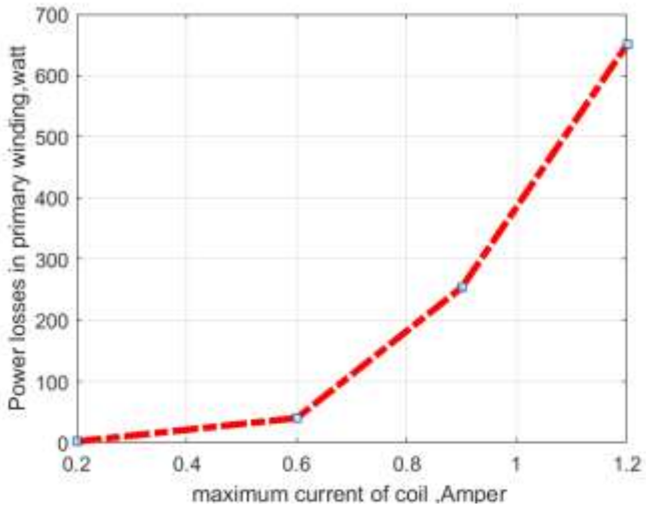



**Figure (17)** relation between maximum current  and power losses in primary of coil

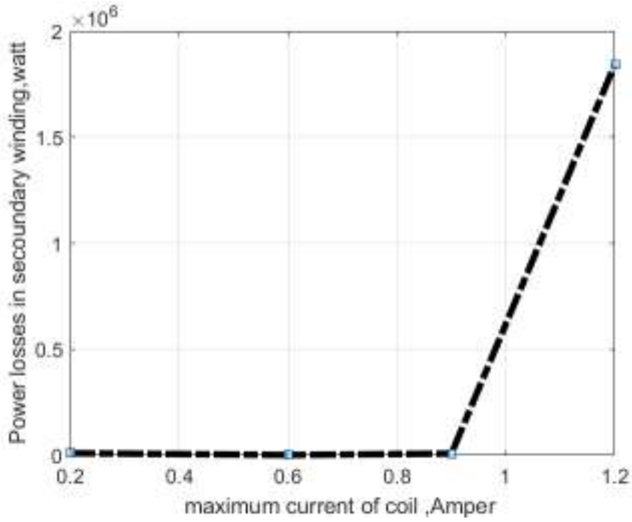



**Figure (18.)** relation maximum current  and power losses in secondary of coil

Figures 19.20 showing power losses with EMF voltage in primary and secondary winding for ignition coil

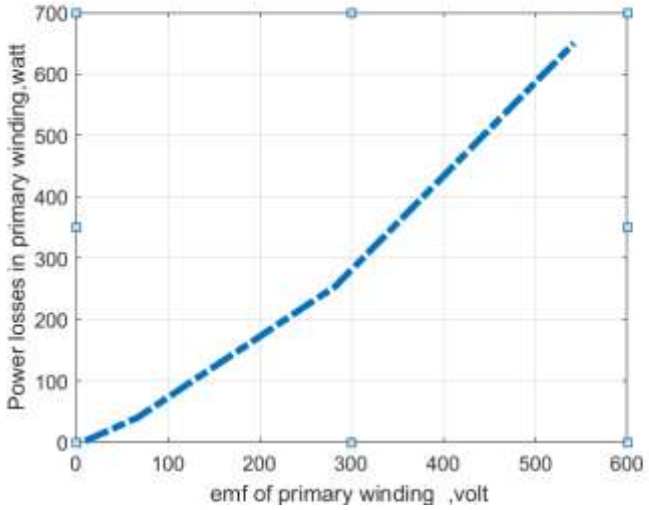



**Figure (19)** relation between power losses primary and power emf in primary of coil

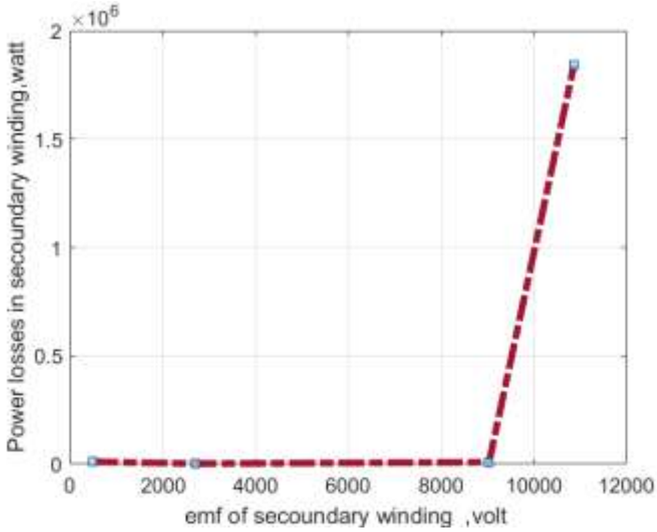



**Figure (20)** relation between power losses secondary and power emf in secondary of coil

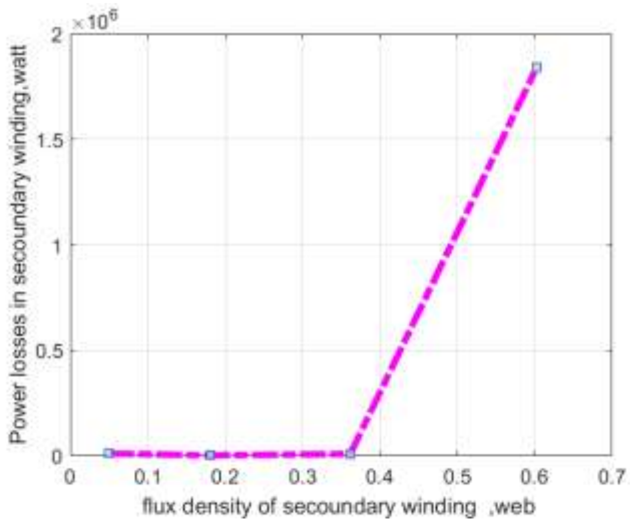
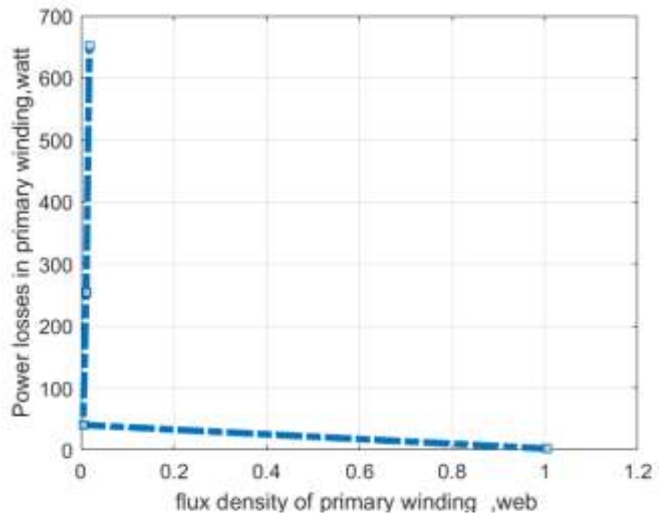



**Figure (21**) relation between power losses secondary and flux in secondary of coil

Figures 21.22,23 and 24 showing respectively power losses ,magnatic flux number of turns EMF voltage in primary and secondary winding for ignition coil .




**. Figure (22**) relation between power losses primary and power emf in primary of coil

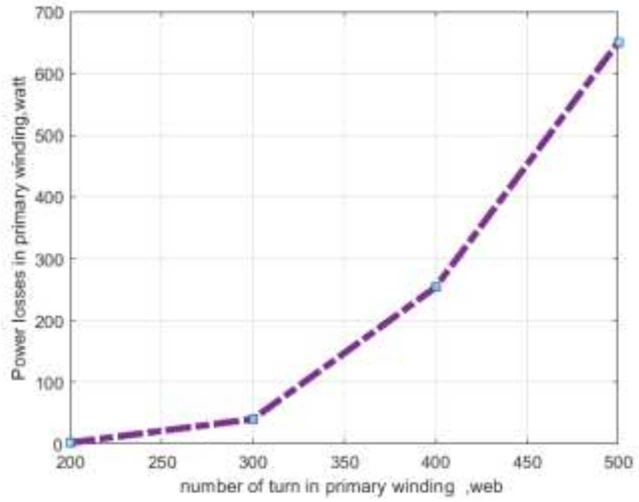



**Figure (23)** relation between power losses primary and number of turn in primaryf of coil

## IV. CONCLUSIONS

This papers show the improving of internal combustion of engine and reducing the exhaust ingine by two methods. The first methods by using fullwave rectifier, and second is increase number of turen in secondary coil turens as shown as in mathematical realtion as shown. As general increase the effcincy of combustion of ingine will provide better performance for motor vehicle those preformace reflact on the nature and inverment by reduceing the pollution on the air and nature life .

## REFERENCES


[1]. Heywood, J.B., 1998. "Internal Combustion Engine Fundamentals", McGraw-Hill, Singapore. "Alternative Fuels", Concept, Technology and Development. By S.S. Thipse, jaico publication house, Chapter-1, 7. Effect of Ignition Energy on Performance and Emission of Dedicated 4-Stroke Single Cylinder S.I Engine Fuelled With Biogas – An Experimental Investigation (IJSTE/ Volume 1 / Issue 11 / 067) All rights reserved by www.ijste.org 399 Internal combustion engine by domkundwar.Chapter-22, page-38 to 47

[2]. "Alternative Fuels", Concept, Technology and Development. By S.S. Thipse, jaico publication house, Chapter-9, Page-162 to 175

[3]. Mr.Ashish M. Ambaliya, Prof. M.A.Shaikh, "A Parametric Study of Four Stroke Single Cylinder C.I Engine Fuelled With LPG for Enhancement of Performance." in June 2014

[4]. Mr Deep M Dave ,Prof. M. A. Shaikh, "Optimization of Ignition Parameters for Enhancement of Performance and Emissions of a Four Stroke Single Cylinder SI Engine Fuelled with CNG" in June 2013

[5]. Mr H L Chavda , Prof. V.G.Trivedi, "Experimental Investigation On Single Cylinder CI Engine With Biogas And Diesel As a Duel Fuel For Measurment Of Performance And Emission." in June 2014

[6]. D.M.Dave, Assi.Prof. M.A.Shaikh, "Effect of Ignition Parameters for Enhancement of Performance and Emission of a Four Stroke Single Cylinder SI Engine Fuelled with CNG: A Technical Review", international journal of Engineering Research & Technology, Vol. 2 Issue 4, April- 2013

[7]. Cassiano Rossetto, Samuel Nelson Melegari de Souza, Reginaldo Ferreira Santo, Juliano de Souza and Otávia Lidia Klaus present on" Performance of an Otto cycle engine using biogas as fuel" VOL.8(45), November 2013

[8]. E. Porpatham , A. Ramesh , B. Nagalingam present on "Effect of swirl on the performance and combustion of a biogas fuelled spark ignition engine." School of Mechanical and Building Sciences, VIT University, Vellore 632 014, India 22 July 2013

[9]. Cheolwoong Park a, Seunghyun Park b, Changgi Kim a, Sunyoup Lee a,b, present on " Effects of EGR on performance of en-gines with spark gap projection and fueled by biogas - hydrogen blends " Department of Environmental System Engineering, University of Science & Technology, Yuseong-gu, Daejeon 305-343, Republic of Korea 19 July 2012

[10]. E. Porpatham, A. Ramesh, B. Nagalingam present on "Effect of compression ratio on the performance and combustion of a biogas fuelled spark ignition engine" VIT University, Vellore 25 October 2011

[11]. R. Chandra, V.K. Vijay, P.M.V. Subbarao, T.K. Khura present on " Performance evaluation of a constant speed IC engine on CNG, methane enriched biogas and biogas " Department of Farm Power and Machinery, College of Agricultural Engineering and Post Harvest Technology, Central Agricultural University, Ranipool, Gangtok, Sikkim 737 135, India 12 April 2011

[12]. Wladyslaw Papacz present on "BIOGAS AS VEHICLE FUEL" Journal of KONES Powertrain and Transport, Vol. 18, No. 1 2011

[13]. Seung Hyun Yoon a, Chang Sik Lee present on "Experimental investigation on the combustion and exhaust emission characteristics of biogas biodiesel dual-fuel combustion in a CI engines" Graduate School of Hanyang University, 17 Haengdang-dong, Sungdong-gu, Seoul, 133-791,Republic of Korea v 30 December 20101

[14]. [16] Jun Li a,b, Chang-Ming Gong a,Yan Su a, Hui-Li Dou b, Xun-Jun Liu a Present On "Effect of injection and ignition timings on performance and emissions".

[15]. from a spark-ignition engine fueled with methanol" State Key Laboratory of Automobile Dynamic Simulation, Jilin University, Changchun 24 June 2010

[16]. REALISATION OF RESONANT CONVERTERS FORAUTOMOBILE IGNITION SYSTEMSThe Parallel Resonant Converter CHAPTER 5

[17]. Yong-Ann Ang Modelling, Analysis and Design of LCLC Resonant Power Converters A thesis submitted for the degree of Ph.D., in the Department of Electronic and Electrical Engineering,The University of Sheffield. April 2005

[18]. Raid Anam Gaib, Ahmed Bassam Aziz and Ahmed Ibrahim Jaber Alzubaydy, 2019. The Effect of Internal Ignition Coil on Combustion Engine Performance. Journal of Engineering and Applied Sciences

Ahmed I. Jaber Alzubaydy" Improvement of Effect ignition Coil on Ignition System of Internal Combustion Engine Performance" American Journal of Engineering Research (AJER), vol.8, no.04, 2019, pp.274-284