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ICE-SEAM 2015

4th International Conference and Exhibition on Sustainable Energy and Advanced Materials

"Energy Efficient and Advanced Materials for Sustainable Development"

Surakarta, November 11-12, 2015
Faculty of Engineering
Sebelas Maret University

PREFACE

Dear Distinguished Delegates and Guests,

The Organizing Committees warmly welcome you to the 2015 4th International Conference and Exhibition on Sustainable Energy and Advanced Materials 2015 (ICE-SEAM 2015), held on November 11, 2015 in Solo, Indonesia. This conference is hosted by Sebelas Maret University (UNS), Indonesia and jointly organized by Universiti Teknikal Malaysia Melaka (UTeM), Malaysia, Brawijaya University, Indonesia and Diponegoro University, Indonesia. The theme of the ICE-SEAM 2015 conference is **"Energy Efficient and Advanced Material for Sustainable Development"**.

The aims of this joint conference are to increase internationalization activities and enhance collaborative relationships between universities, disseminate information, technology, engineering, performance and the latest scientific discoveries in the field of engineering at the international level and provide information and exposure to the industry and other institutions on the progress and opportunities for collaboration in research and consultancy hence strengthen networking between academicians, scientists, engineers and technologists at regional and international levels.

More than 85 papers were submitted to ICE-SEAM 2015 and around 72 papers are accepted for the conference after peer reviewed by reviewers drawn from the scientific committee, external reviewers and editorial board depending on the subject matter of the paper. Reviewing and initial selection were undertaken electronically. After the peer-review process, the submitted papers were selected on the basis of originality, significance, and clarity for the purpose of the conference.

We would like to thank the Rector of UNS for financial supporting, the keynote speakers, the program chairs, organization staff, the members of the committees and our sponsors for their work. Thanks also go to all those who have contributed to the success of ICE-SEAM 2015.

Hopefully, all participants and other interested readers benefit scientifically from the conference.

We hope all of you have a unique, rewarding and enjoyable week at ICE-SEAM 2015 in Solo.

With our warmest regards,

Dr. Triyono

Solo, Indonesia

November 11, 2015

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Mechanical Engineering Department, Engineering Faculty, Sebelas Maret University, Surakarta, Indonesia.

E-mail: triyonomesin@uns.ac.id

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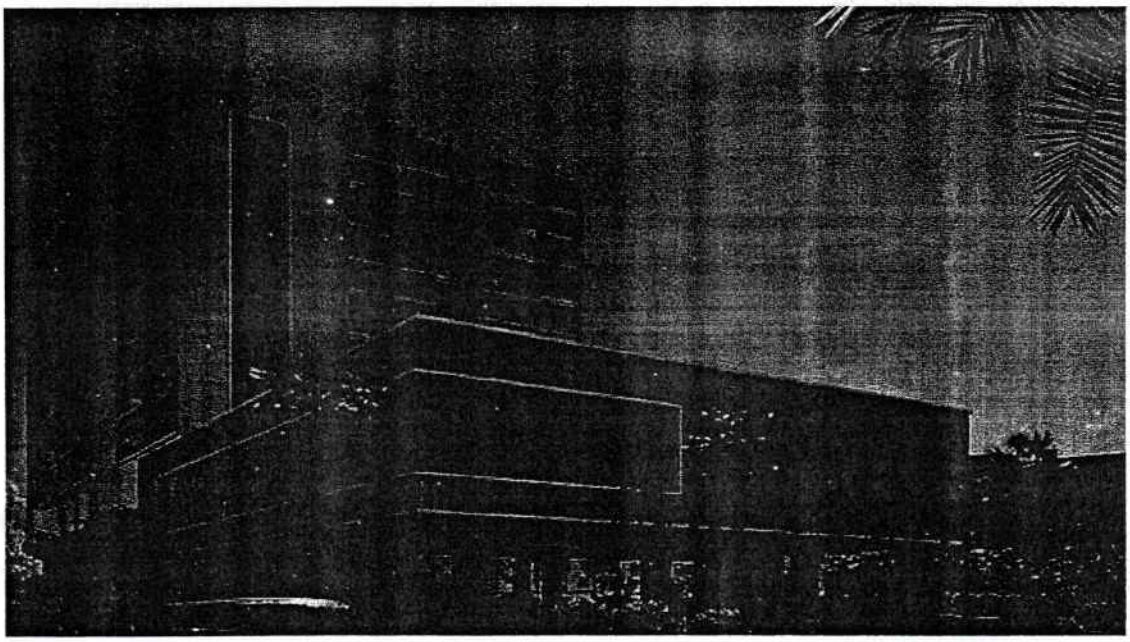
ICE-SEAM 2015

"Energy Efficient and Advanced Material for Sustainable Development"

SOLO, NOVEMBER 11, 2015



THE ALANA HOTEL, SOLO, INDONESIA

ANNOUNCEMENT

ICESEAM 2015 conference proceeding will not be available on conference site but it will be available on AIP site after conference.

Conference venue was moved to The Alana Solo Hotel.

Please join Gala Dinner on November 11, 2015 at 07.00 pm in Archadia Ballroom 1, The Alana Solo Hotel.

Please join city tour on November 12, 2015. It is free.

INSTRUCTIONS FOR ORAL PRESENTATIONS

Devices Provided by the Conference Organizer:

Laptops (with MS-Office & Adobe Reader)
Projectors & Screen
Laser Sticks

Materials Provided by the Presenters:

PowerPoint or PDF files
(Files shall be copied to the Conference Computer 10 minutes earlier before each Session)
Duration of each Presentation (Tentatively):
Regular Oral Session: about 10 Minutes of Presentation, including Q&A

Dress code

Please wear formal clothes or national characteristics of clothing

11 November 2015	
07.30 – 08.30	Registration – Archadia Ballroom 1
08.30 – 08.45	Opening Dance
08.45 – 09.00	Opening Ceremony : Dr. Triyono
09.00 – 09.30	Opening Speech : Rector of UNS
09.30 – 10.00	**Coffee Break**
	Keynote Session – Archadia Ballroom 1
10.00 – 11.30	Keynote Session : Chair – Dr. Agung Tri Wijayanta
	Keynote Speech 1 : **Professor Dato' Dr. Abu Bin Abdullah**
	Keynote Speech 2 : Dr. Abdul Hakim Almajid
	Keynote Speech 3 : Associate Professor Kosaku Kurata
11.30 – 12.00	Question and Answer
12.00 – 13.00	**Lunch**
13.00 – 15.00	Parallel Session 1
15.00 – 15.30	**Coffee Break**
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12 November 2015	
	City Tour (by request)
08.00 – 13.00	Museum Mangkunegaran, Ngarsopuro Antique Market, Danar Hadi Batik Museum, Laweyan Batik Village

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A study experiment of auto idle application in the excavator engine performance

Wawan Purwanto, Hasan Maksum, Dwi Sudarno Putra, Meri Azmi, and Retno Wahyudi

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View Table of Contents: http://scitation.aip.org/content/aip/proceeding/aipcp/1717?ver=pdfcov
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A Study Experiment of Auto Idle Application in the Excavator Engine Performance

Wawan Purwanto[1, a)], Hasan Maksum[1)], Dwi Sudarno Putra[1,b)], Meri Azmi[2,c)] and Retno Wahyudi[1)]

[1]*State University of Padang, West Sumatera, Indonesia*
[2]*State Polytechnic of Padang, West Sumatera, Indonesia*

[a)]*wawan5527@gmail.com,*
[b)]*dwisudarnoputra@ft.unp.ac.id,*
[c)]*meriazmi@gmail.com*

Abstract. The purpose of this study was to analyze the effect of applying auto idle to excavator engine performance, such as machine unitization and fuel consumption in Excavator. Steps to be done are to modify the system JA 44 and 67 in Vehicle Electronic Control Unit (V-ECU). The modifications will be obtained from the pattern of the engine speed. If the excavator attachment is not operated, the engine speed will return to the idle speed automatically. From the experiment results the auto idle reduces fuel consumption in excavator engine.

INTRODUCTION

Excavators are heavy equipment be used as leverage, loading and transfer of material from one place to another. In addition excavator can also be a means of multiplier or breaker material when using the attachment as rock breaker and hammer. Currently excavator has implemented a high-tech, all activities in the control using the Electronic Control Unit (ECU). The latest release of each excavator equipped with a minimum of 3 ECU (engine management systems, electronic vehicle control system, and display electronic control units) [1].

High technology in the excavator should contribute positively to the improvement of production performance. Genesis in the field, to increase production, operator operate an excavator at high speed irregular. Such as the positioning speed of the engine at maximum speed position, move the control lever to the maximum angle, so the hydraulic flow is higher. To avoid losses arising from the operation, in this paper design a system modification that can regulate the speed of the machine back to the idle position.

Idle speeds control in automotive engines is one populer in the vehicle technology [2,3]. Mostly the focus of engine idle speed control is returns the idle position when the attachment is not in used. The idle speeds control problem consist of finding a control strategy that maintains, while in the idle mode, rejecting torque disturbances due to accessory loads, and preventing the engine from stalling [4,5]. The focus of this study is the application of automatic idle and applying it to an excavator. Experiment done to look at the success of modifications that have been done that on fuel consumption and machine utilization.

EXCAVATOR SPEED CONTROL

In the application, the excavator is equipped with 10 speed levels that can be adapted to the type of excavator applications. Each level has a fixed specification engine speed. Suitability pace in excavator applications can affect engine performance and fuel consumption. At engine speed settings, excavators utilize a selector switch. The working model of the excavator is [1,2]:

I (idle) mode. I mode the excavator is divided into two part that is I2 and I1. I mode is used as warming up and the engine speed when the excavator will climb the trailer for the purposes of the transfer from one site to another site. Speed distribution for the I mode ranges between 800-1000 rpm. In the first mode, the power generated by the engine is higher.

F (fine) mode. F Mode on the excavator is divided into three levels, namely F3, F2, and F1. F mode is used for the purposes of the appointment. F mode results highest torque, the 210 class excavator, the highest torque at 1300 to 1500. In the F mode is also equipped with a power boost that can increase the pressure in the hydraulic system. In the standard hydraulic system is 320 bar, but by activating the power boost hydraulic pressure can be increased to 350 bar. Increasing the pressure on the hydraulic system which causes the increased torque excavator [1].

G (general) mode. G mode in the excavator is divided into three levels, namely G3, G2, and G1. G mode employed in jobs that require speed and torque. In the multiplication, it is recommended to use G mode. It is mode ranges from 1500-1800 rpm.

H (high) mode. H mode is the speed of the excavator in the range between 1800-1900 rpm. In this mode, the excavator produced higher engine power and low torque. H mode is used for very precise finishing jobs that do not require high torque but requires rapid movement.

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AIP Conf. Proc. 1717, 050010-1–050010-5; doi: 10.1063/1.4943485

P max (Power maximum) mode. In the P mode, the engine speeds is higher but the engine torque is low. In the P mode, the engine speed range between 1900-2000 rpm. For a comparison of power and torque produced on the excavator as shown in Fig. 1.

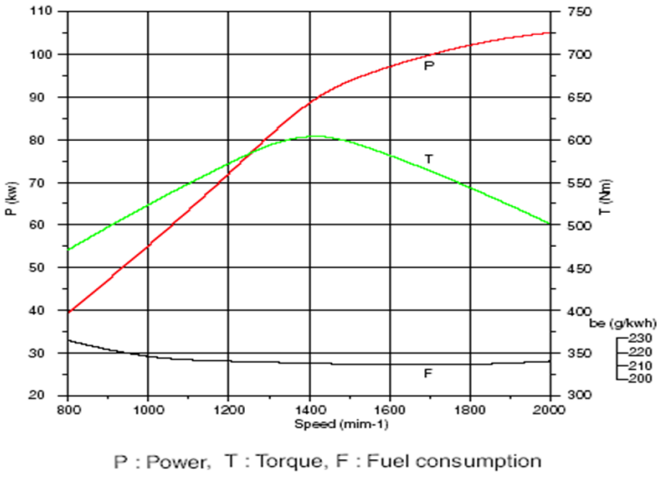


FIGURE 1. Power and torque comparison curve

DESIGN OF EXCAVATOR AUTO IDLE SPEED

Automatic idle speed is a design of the engine speed settings from high speed into a low speed. This system is usually automatically controlled by the ECU. At ECU systems occurs all processes and procedures undertaken machines including, spraying fuel into the combustion chamber, how much time spraying fuel into the combustion chamber, as well as the number of cylinder in the fuel spray, all arranged by the ECU.

Automatic idle speed applied to fuel savings and optimizes the functioning of the entire system on the excavator. In the system of heavy equipment engine speed is fixed in accordance with the position of the selector switch. So that when the selector switch is positioned at certain speeds, the engine speed constant in the position of the mode of the selector speed. Becomes less effective when moving the excavator to the application under the 60% workload engine, the engine speed is used is a high speed. Besides high speed will increase fuel consumption and also reduce the torque produced by the engine. It is necessary to design a system, when the excavator attachment does not work or travel, the engine speed can return to the idle speed. This pattern is named with excavator automatic idle speed control.

Not all systems can be applied using automatic idle speed, only the excavator which has been in control with ECU can be applying this system. At ECU system, this system has not been applied automatically only made as an option. The application can be done on the automatic idle speed of the engine above 1000 rpm, so when the excavator standby (no travelling or moving the equipment) then automatically within 5 seconds the engine speed will return to 900 rpm.

The application of automated design idle speed can be done by turning off the switch so the JA 44 and 67 on Vichicle Electronic control unit directly in combination as shown in Fig. 2. This combination will not cause any side effects due to the input voltage at the JA 44 and 67 each of 5 V. With the same input and ouput safe when in combination [9]. The concept from automatic idle work is, if there is no information from the travel pilot pressure switch and a attachment pilot pressure switch, the engine speed will automatically be dropped in the idle position ranging from 900 rpm.

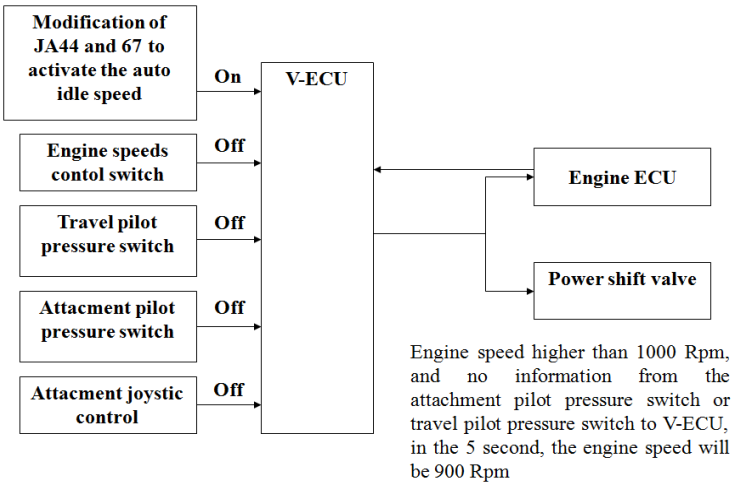


FIGURE 2. Auto idle outline

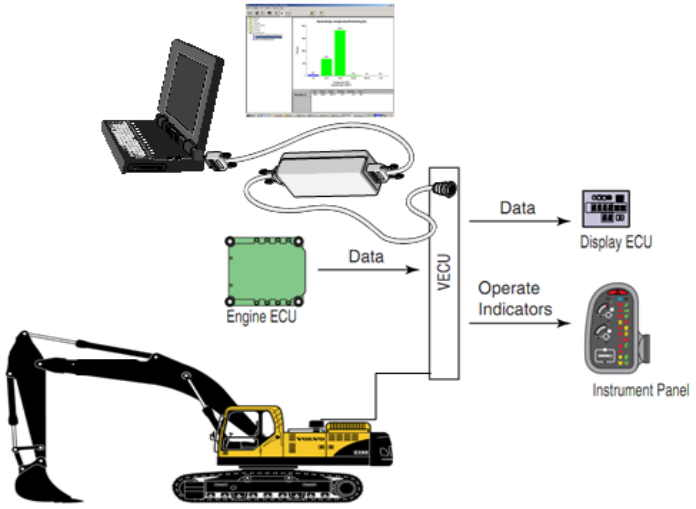


FIGURE 3. Experiment setup

EXPERIMENT SETUP

Research was conducted on EC210 BLC excavator, this unit was working in sand mining. The research process will begin with the download operating data on the excavator, the information data is used to see historical machine, prior to the application of automatic idle. Download the information data in the excavator by using machine tracking information system (matris) software. After downloading the data, the excavator V-ECU system is modified in accordance with the concept of auto idle speeds, as shown in Fig. 3. After reaching a certain working hours, do download the data back to determine the performance of the excavator during idle automatically applied. Results of the data before the application and after the application is then analyzed to determine the effect of the application of the automatic idle on engine performance excavator.

Machine utilization, distribution of fuel consumption per working mode, and power boost operation became major parameter in measuring the effect of the auto idle on engine performance. The excavator has been equipped ECU all these parameters are read by the sensor and stored in the ECU. The data storage will become primary data in this study.

EXPERIMENT RESULT AND DISCUSSION

Figure 4 shows the engine operating time during machine utilization in percent. V-ECU calculates the operating time of the machine starts the ignition switch in ON, as long as the ignition switch in on position, the supply current to V-ECU has occurred so that the data storage process was happening at the time. 825.1 hours during machine operation, 79% excavator used to work and 21% excavator is not used for work, as shown in Fig. 4(a). While the use of the machine after the application of the automatic idle for 1446.6 hours excavator used to do the working as much as 76% (1099.42 hours) is used for the working, as shown in Fig.4 (b). While 24% (347.18 hours) the excavator is not used for working. V-ECU calculates the length of time the excavator works of movements performed by the working attachment or traveling. When the excavator in idle condition, the utilization of the machine is becomes low.

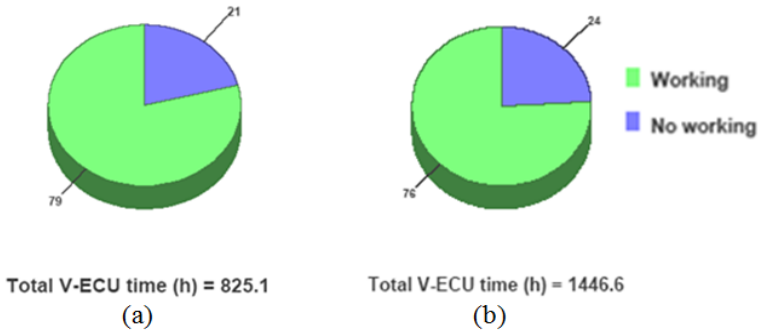


FIGURE 4. Machine utilization, a) before auto idle speed application, b) after auto idle speed applications

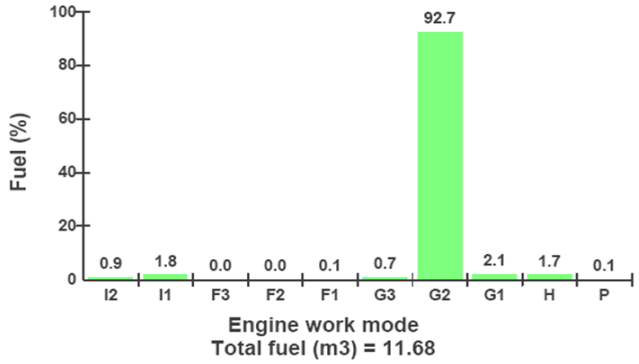


FIGURE 5. Fuel distribution in work mode

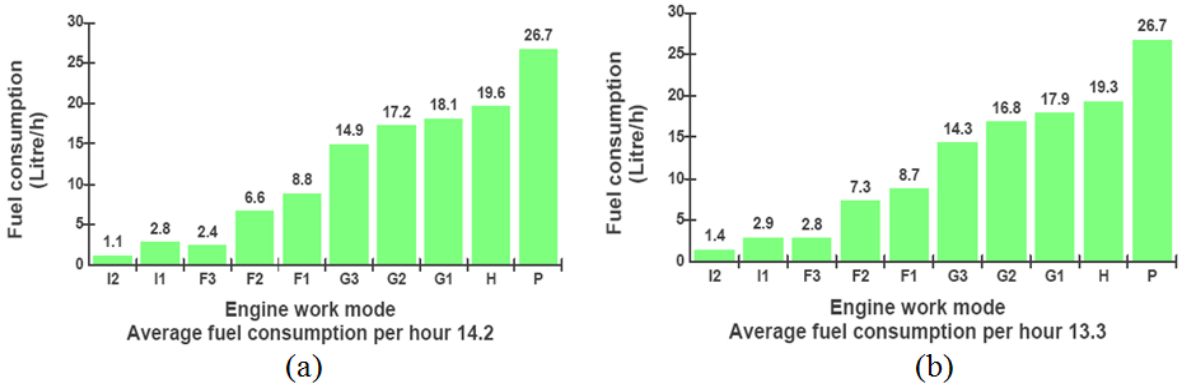


FIGURE 6. Fuel consumption on work mode per hour, a) before auto idle speed application, b) after auto idle speed application

Fuel consumption is highest in the G2 (General 2) mode that is equal to 92.7% of total fuel consumption 11.68 M3, as shown in Fig 5. Application of excavator at sand quarry, while working in multiplication material required torque and speed, it is suitable in G mode engine speed. This result indicates excavator while working frequently used G2, then G1 mode with a 2.1% fuel consumption of 11.68 or 0.25 M3 (245.28 liters). Fuel consumption on average operation hours with specifications according to the excavator work mode. As shown in Fig. 4. In the note, in this experimental results I1 mode consume high fuel consumption, It is caused every excavator standby with does not moving attachment and travelling, the engine speed will returns in I1. It indicates that the ECU reads the working mode at I1 more in use than F3. After application of the auto idle speed, decrease fuel consumption in an hour. Where prior to the application of auto idle fuel consumption per hour as much as 14.2 liters per hour, as shown in Fig 6 (a) and after the application of the auto idle obtained fuel consumption of 13.3 liters per hour, as shown in Fig 6 (b). Fuel consuptions per work mode of excavator is shown in Table 1.

In terms of the use of the engine speed before application and after application of the auto idle speed is the same, namely at 1601 - 1800 rpm (G2). This means that the application before and after the application of the automatic engine idle speed is the same as that applied operator G2. Seeing the many start engine performed by the operator prior to and after the application is idle automatically at an average of every 0.5 hours at doing start the engine. While the distribution of engine heat, low pressure in the lubrication system, low pressure in the intake air (air filter) have in common both before and after the implementation of the application. This indicates that during engine operation to avoid problems in the system, which can lead to low power engine that can affect of the engine performance. In the process of using the power boost employment before the application is as much as 57 hours while auto idle speed after application of 115 hours, this is due to the operation of the F mode and when traveling on the excavator power boost is automatically activated, as shown in Fig.7. Total power boost activation is calculated by V-ECU.

TABLE 1. Fuel comsumptions per work mode

No	Mode	Fuel consuption per work mode % (M^3)/(liter)
1	I_2	0.9 (0.11)/(105.12)
2	I_1	1.8 (0.21)/(210.24)
3	F_3	0.0 (0.0)/(0.00)
4	F_2	0.0 (0.0)/(0.00)
5	F_1	0.1 (0.01)/(11.68)
6	G_3	0.7 (0.082)/(81.76)
7	G_2	92.7 (10.83)/(10827.36)
8	G_1	2.1 (0.25)/(245.28)
9	H	1.7 (0.2)/(198.56)
	P	0.1 (0.01)/(11.68)

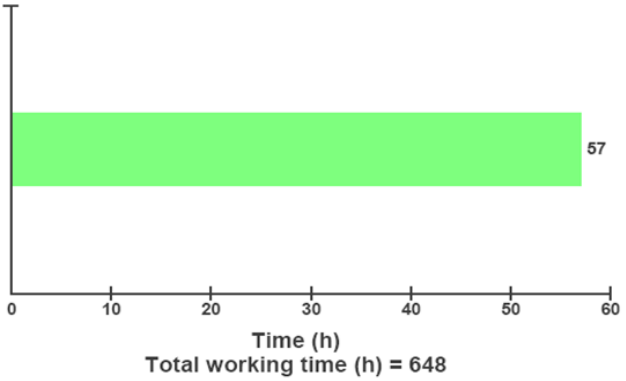


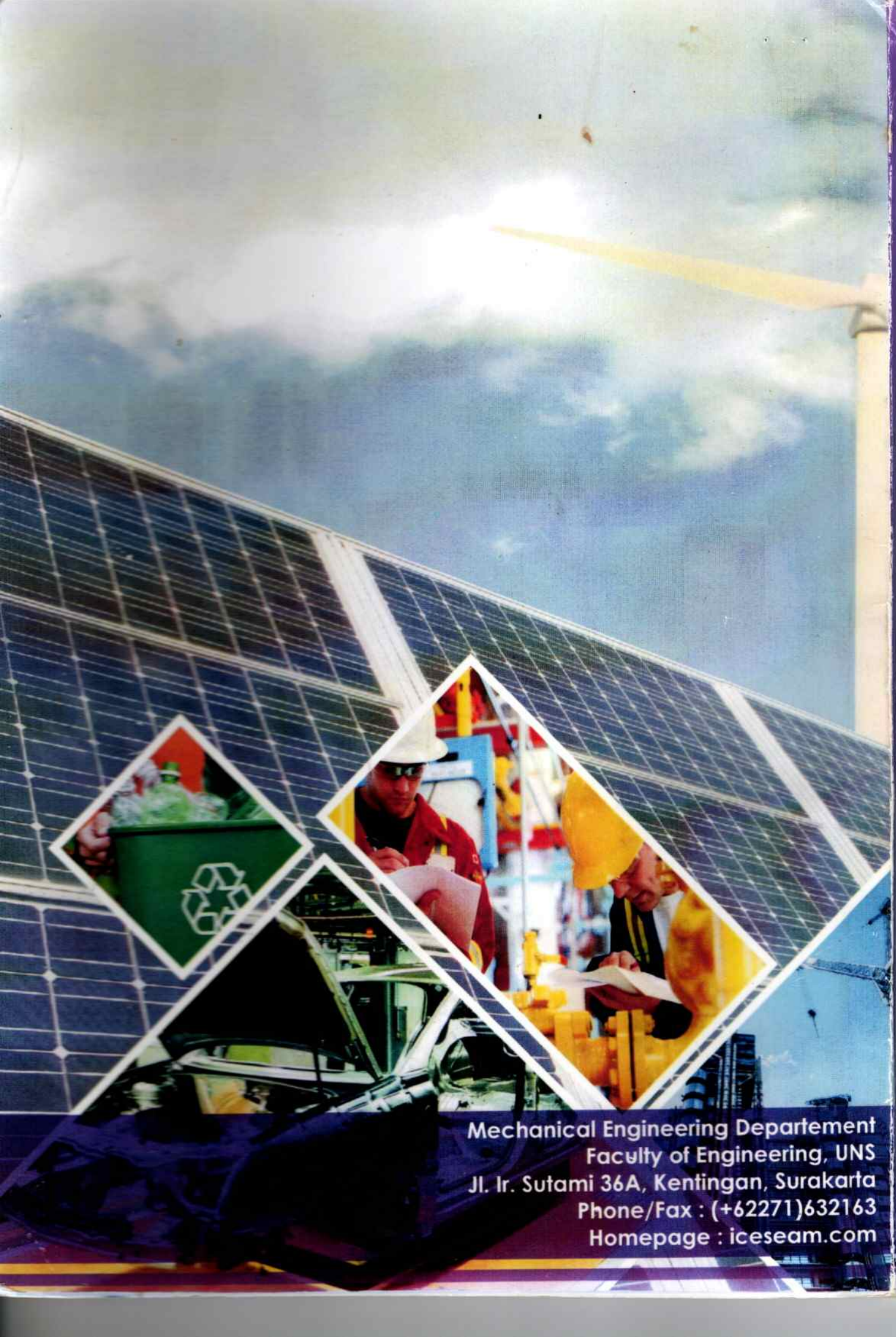
FIGURE 7. Power boost operation

CONCLUSION

From the experiments that have been conducted to apply the auto idle on the excavator, so automatically when attachment not used, the engine speed will return to the idle position. The return of the engine at idle position impact on the reduction of fuel consumption. The application of auto idle pattern by connecting JA 44 and 67 on V-ECU. From the analysis of the data shows, before the application of auto idle use of the machine to work as much as 79% and 21% are not used. While the application of auto idle machines use to work as much as 76% whereas there used to work as much as 24%. With fuel consumption per hour when not applying auto idle 14.2 liters per hour and after applying auto idle became 13.3 liters per hour.

REFERENCE

1. *Operation and maintenance manual EC 210BLC* (Volvo Contruction equpment, Busan, Korea, 2008).
2. *Workshop manual PC200LC-8* (Komatsu, Japan, 2002).
3. D. E. Kim and Jaehong. P, Information Sciences. **177,** 3341–3355 (2007).
4. M. Thornhill, S. Thompson and H. Sindano, Control Engineering Practice. **8,** 519-530 (2000).
5. E. D. Santis, M. D. D. Benedetto and G. Pola, Nonlinear Analysis. **65,** 1705–1724 (2006).
6. G. De Nicolao, C. Rossi, R. Scattolini and M.Sufritti, Control Engineering Practice. **7,** 1061-1069 (1999).
7. M. N. Howell and M. C. Best, Control Engineering Practice. **8,** 147-154 (2000).
8. Hadi. T, S. Khalilarya, S. Mirhasani and S. Jafarmadar, International Journal of Hydrogen Energy. **39**, 9515-9526 (2014).
9 *Service manual EC 210BLC* (Volvo construction equipment, Busan, Korea, 2009).



Mechanical Engineering Departement
Faculty of Engineering, UNS
Jl. Ir. Sutami 36A, Kentingan, Surakarta
Phone/Fax : (+62271)632163
Homepage : iceseam.com