

OPTIMIZATION OF SUPRA FIT MOTORCYCLE ENGINE MODIFICATION INTO A MACHINE CONVERTING HEAT ENERGY INTO ELECTRIC ENERGY

Bilhan Gamaliel¹

¹Department of Mechanical Engineering, Faculty of Engineering, Krisnadwipayana University
Email : bilhan.gamaliel.h@unkris.ac.id

ABSTRACT

The relatively high population growth rate as a result of the development in South Tangerang City has caused traffic jams during rush hour at the Gaplek intersection. This congestion can be minimized by constructing a Martadinata flyover without disturbing the existing transportation movements. Heap construction is often faced with several problems, including stability and reduction problems due to the weight of the pile load, due to vehicle traffic loads, and due to being above soft soil layers. This study aims to obtain the magnitude of the carrying capacity of the subgrade under light weight foam mortar, to obtain the amount of stability and reduction of light weight foam mortar to soft soil behavior. Comparative research to get a comparison between manual calculation and finite element calculation method plaxis 8.2 software. The results of the bearing capacity of the soil under lightweight foam mortar at a soil depth of 1.5 meters and 10 meters, the soil bearing capacity is 366,481 kN/m² and 376,295 kN/m². The stability results of the lightweight foam mortar pile above the soft soil layer due to the weight of the pile load of 3.52 and 12.53 due to vehicle traffic loads of 3.05 and 9.54 have met the minimum safety factor requirements for road class 1 of 1.4. The results of the reduction of light weight foam mortar are above the soft soil layer due to the weight of the embankment load of 11.91 mm/year and 12.61 mm/year, due to vehicle traffic loads of 15.25 mm/year and 20.06 mm/year. meet the criteria for road embankment reduction of 20mm/year. So it can be concluded that the foam mortar stockpile at the Martadinata Pamulang Tangerang Selatan flyover has met the requirements in the technical planning guidelines for lightweight foam mortar pile on soft soil.

Keywords: Flywheel, Pulley, Response Surface Methodology, V-belt, Volt.

INTRODUCTION

Electrical energy is a very vital need in everyday life. Day by day the need for electrical energy is increasing, where the industrial, service, transportation and other sectors are very dependent on this energy. Of course, because demand for electricity increases, fossil fuels in the form of oil, coal and gas, including energy sources in the world, are accelerating their reserves in nature. For this reason, it cannot be denied that accelerating the use of renewable energy is the most urgent reason at this time.

One of the best energy conversion machines is a steam engine because it can convert steam into mechanical energy. The idea of the steam engine dates back to 100 BC. The aim of the steam engine is to produce electrical energy ranging from 10 to 15 voltages which functions to charge the battery, where the battery has the task of supplying electricity to several components such as the mist spray fog maker and a fan which has a voltage of 12 voltages, one of which is The function of this tool is to be used for the mushroom farming process in the cultivation area in order to maintain the room temperature conditions in

the place which are always humid. The type of steam engine used is made from a 125 cc supra fit engine which has previously been modified and functions well. However, the electricity produced is not optimal, namely it is still around 7 to 8 voltages, so it is still not possible to charge the battery which has a voltage of around 12 voltages, where the electrical power needed to charge the battery is 10 to 15 voltages. Therefore, the factors that have an influence on the amount of current produced need to be investigated further using an experimental design.

For this reason, the experimental design that will be carried out in this research uses the Response Surface Methodology method. Henceforth we will call Response Surface Methodology RSM. In essence, RSM uses adjustments to linear mathematical models, quadratic polynomial functionals, etc. with several series of experiments designed and verified with models obtained using statistical techniques. If we look at previous research, what differentiates this research is the use of 4 supporting factors, namely pulley, flywheel and v-belt, while the response indicator measured is the current voltage produced. The resulting output is the influence of factors on the response and maximum conditions of steam engine experiments in order to solve problems related to optimizing steam engine design characteristics.

LITERATURE REVIEW

Electricity generation is the conversion of one form of energy into another form of energy where the final form is electrical energy. The form or form of energy above its existence or position is as follows:

- 1) Fuel contains chemical energy;
- 2) Then a combustion reaction occurs which produces heat which is then transmitted to the boiler pipe walls, where it is received by the boiler water as heat energy;
- 3) Then kinetic energy occurs where the steam energy changes as a function of speed pushing the angle of rotation of the turbine shaft;
- 4) Mechanical energy is a concentration of energy located in the turbine shaft axis;
- 5) The rotation of the turbine shaft is transmitted to the generator shaft to produce electricity, this is where the final product in the form of electrical energy is produced.

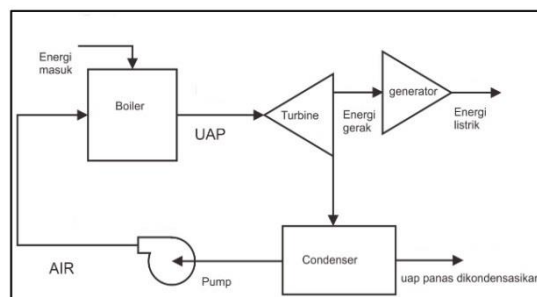


Figure 1. PLTU Cycle Flowchart

The elements of power transmission are several components that are used to transfer energy or power from one component to different components in a mechanical system. Some common elements of power transmission include the following:

- 1) Flywheel

It is an element that has a disc-like shape which has the function of maintaining the smooth rotation of a machine.

- 2) V-belt

The V-belt functions as a transmission link which is made of rubber and has a cross-sectional design that is almost similar to the letter "V" which encircles a similar shaped pulley groove.

3) Pulleys

One of the components that plays a role in the machine mechanism is to transmit energy from one axis to another using a belt.

METHOD

The object of this research is a steam engine modified from a supra fit motorbike engine. This research includes:

- 1) Measure the output current from the alternator using a multimeter;
- 2) Turning on the steam engine, the steam engine experimental design begins by heating the boiler tube.

This research was carried out in the manufacturing laboratory of the Faculty of Engineering, Krisnadwipayana University because all the equipment and materials needed are located or available in the laboratory.

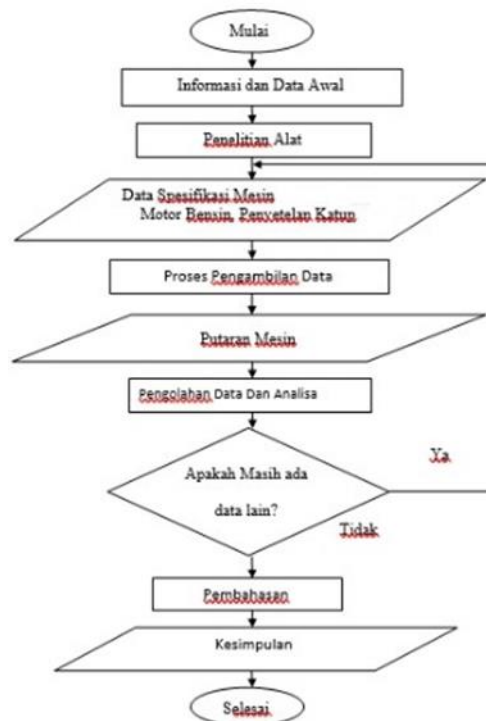


Figure 2. Research Flow Diagram

RESULTS AND DISCUSSION

The data collected in this research came from direct observations in the field. The data obtained is in the form of electrical voltage results. Data collection was carried out from March 20 2023 to March 27 2023 by carrying out 2 to 3 experiments.

Table 1. Experimental Results Data

No.	Diameter Pulley (cm)	Diameter Flywheel (cm)	Kekencangan V-belt (cm)	Listrik yang dihasilkan (Voltage)
1	15	10	5	6.7
2	45	10	5	8.1
3	15	30	5	11.9
4	45	30	5	13.7
5	15	10	15	4.1
6	45	10	15	6.4
7	15	30	15	8.8
8	45	30	15	10.2
9	15	20	10	7.6
10	45	20	10	9.4
11	30	10	10	5.3
12	30	30	10	10.6
13	30	20	5	9.7
14	30	20	15	7.6
15	30	20	10	8.5
16	30	20	10	8.5
17	30	20	10	8.5
18	30	20	10	8.5
19	30	20	10	8.5
20	30	20	10	8.5

It can be seen in Table 1 that the percentage of experimental results from 3 factors and 3 levels, in each experiment the results were 4.1 to 13.7.

From the data that has been obtained, data processing is carried out using Minitab 18 software to analyze and build models. The experimental design method chosen was response surface methodology with a central composite design type. There are 3 factors that are input, namely v-belt tightness, flywheel diameter, pulley diameter. The experimental design carried out was 14 times plus the center point 6 times, so the total experiment that was carried out was 20 times.

REGRESSION

Regression is used to fit mathematical models obtained to experimental data. The results are summary statistics on three orders of polynomials: first, second, and third, which translate into pulley diameter, flywheel diameter, and v-belt tightness respectively.

Table 2. Regression

Term	Coef	SE Coef	T-Value	P-Value
Constant	8,4073	0,0868	96,87	0,000
D Pulley	0,8700	0,0798	10,90	0,000
D Flywheel	2,4600	0,0798	30,81	0,000
K V-belt	-1,3000	0,0798	-16,28	0,000

The prediction model for the response to the weight of the burger product is linear. The mathematical model for the thickness response is: $\text{Weight} = 14.15 - 0.22C$, where C is the temperature (o C). The weight response mathematical model shows that there is a relationship between the weight response and the temperature factor, if the temperature is increased it will cause the weight of the resulting product to decrease. This can be influenced because the lower the temperature used, the more compact the product will be, which can increase the weight of the final product produced.

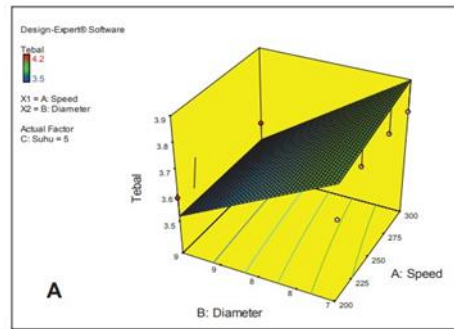


Figure 3. 3D profile of the thickness response

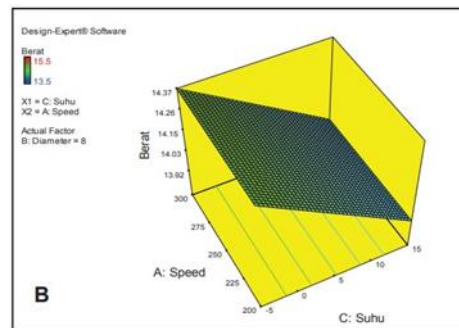


Figure 4. 3D profile of weight response

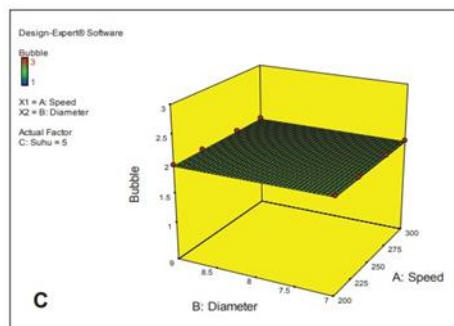
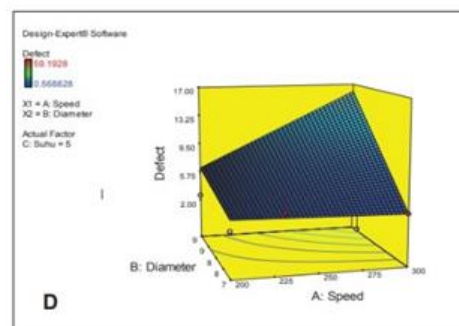


Figure 4. 3D profile of the bubble response



Gambar 5. Profil 3D dari respon defect

Sistem Oscillating Water Column (OWC) merupakan sistem dengan konstruksi yang terdiri dari dua komponen utama, yaitu ruang udara (Air Chamber) dan Turbin Udara Generator (air turbine generator).

Kesemuanya ini direncanakan untuk membangkitkan energi listrik melalui turbin generator yang dapat berputar karena tekanan udara yang disebabkan oleh gerakan naik turunnya gelombang didalam ruang udara tetap. Gerakan naik turunnya air pada kolom osilasi diasumsikan sebagai piston hidrolik.

Piston ini selanjutnya menekan udara yang berfungsi sebagai fluida udara. Udara yang bertekanan tersebut akan menggerakkan turbin udara yang selanjutnya menggerakkan generator listrik. Proses pengubahan dari energi gerak gelombang kepada energi potensial tekanan udara berlangsung secara isothermis.

Pendekatan ini dipilih karena dalam proses kompresi ini dianggap tidak terjadi peningkatan temperatur yang berarti. Besarnya kompresi tergantung kepada Panjang langkah piston, sedangkan panjang langkah piston dipengaruhi oleh tinggi gelombang (H) dan efisiensi absorpsi gelombang pada kolom osilasi.

CONCLUSION

From the results of the regression equation, it can be explained that the constant value of 8.407 has a positive number, which means that if the sum of the pulley diameter, flywheel diameter and v-belt tension is equal to 0, it produces a voltage of 8.407. while the regression coefficient for pulley diameter, flywheel diameter and v-belt tightness increases by one unit for each factor, increasing by 0.870 for pulley, 2.460 for flywheel and -1.300 for v-belt, whereas every decrease in the level of the factor will reduce it. The optimal voltage conditions seen from the response surface and contour plot are at a pulley diameter factor of 45 cm, flywheel diameter of 30 cm, and vbelt tension of 5 cm, producing an electrical voltage of 13.7 volts.

BIBLIOGRAPHY

- Rumbyarso, Y. P. A. (2023). Penyuluhan Komposisi Campuran Beton untuk Jalan Tol. *Journal of Social Work and Empowerment*, 2(3), 137-144. <https://doi.org/10.58982/jswe.v2i3.429>
- Rumbyarso, Y. P. A. (2023). Re-planning of Concrete Structures in the Ngoro Dormitory Project in Surabaya. *Journal of Applied Science, Engineering, Technology, and Education*, 5(1), 15-24. <https://doi.org/10.35877/454RI.asci1592>
- Yonas Prima Arga Rumbyarso. (2021). PERENCANAAN STRUKTUR BANGUNAN ATAS (UPPER STRUCTURE) GEDUNG STIE BANK BPD JATENG KOTA SEMARANG. *TEKNOKRIS*, 24(1), 1–7. Diambil dari <https://jurnalteknik.unkris.ac.id/index.php/teknokris/article/view/89>
- Yonas Prima Arga Rumbyarso, & Gali Pribadi. (2022). PENYULUHAN TENTANG PENTINGNYA SEBUAH KONTRUKSI BAGUNAN RUMAH YANG BAIK SERTA TAHAN GEMPA. *KRIDA CENDEKIA*, 1(08). Retrieved from <http://www.kridacendekia.com/index.php/jkc/article/view/85>
- YONAS PRIMA ARGAS RUMBYARSO, GALI PRIBADI, & FAIZAL ADDIN ACHMAD. (2023). PENGENALAN DASAR – DASAR PENGOLAHAN DATA PADA SMK PGRI 4 JAKARTA MENGGUNAKAN APLIKASI SPSS. *KRIDA CENDEKIA*, 2(02). Retrieved from <https://kridacendekia.com/index.php/jkc/article/view/132>

- Pribadi, G., & Arga Rumbyarso, Y. P. . (2023). Analisis Profil Atap Baja WF dengan Metode LRFD Menggunakan SAP 2000 dan Idea StatiCa. *Jurnal Teknik Industri Terintegrasi (JUTIN)*, 6(4), 1543–1559. <https://doi.org/10.31004/jutin.v6i4.21662>
- Pribadi, G., & Yonas Prima Arga Rumbyarso. (2023). Analisis Perbandingan Daya Dukung dan Penurunan Pondasi Tiang Bor Dengan Perhitungan Manual dan Software ALLPILE. *Jurnal TESLINK : Teknik Sipil Dan Lingkungan*, 5(2), 16-20. <https://doi.org/10.52005/teslink.v5i2.301>
- Achmad, F. A. ., & Rumbyarso, Y. P. A. . (2023). Analisis Struktur Slab On Pile terhadap Kontrol Lendutan pada Proyek Jalan Tol Kataraja. *Jurnal Pendidikan Tambusai*, 7(2), 13457–13467. <https://doi.org/10.31004/jptam.v7i2.8530>
- Darmiyanti, L., Prima, Y., & Aldianto, M. A. (2023). Analisis Borepile Menggunakan Metode Meyyerhoff dan Reese Wright. *Jurnal Sipil Krisna*, 9(1), 27–38. <https://doi.org/10.61488/sipilkrisna.v9i1.249>
- Rumbyarso, Y., Chusna, N., & Khumaidi, A. (2022). Dissolved Oxygen Prediction of the Ciliwung River using Artificial Neural Networks, Support Vector Machine, and Streeter-Phelps. *Jurnal Ilmiah Merpati (Menara Penelitian Akademika Teknologi Informasi)*, 10(3), 180-190. doi:10.24843/JIM.2022.v10.i03.p06
- Yonas Prima Arga Rumbyarso. (2022). Analisis Perkuatan Rangka Atap Baja pada Bangunan Gedung Heritage 1921 Menggunakan Software SAP 2000. *Jurnal Teknik Indonesia*, <https://jti.publicscientificsolution.com/index.php/rp/article/view/2>
- Yonas Prima. (2022). Analisis Daya Dukung Kawasan Pendidikan STT Wastukencana (Studi Kasus Gedung STT Wastukencana). Vol. 18 No. 1. *Jurnal Ilmiah Plano Krisna*. <https://jurnalteknik.unkris.ac.id/index.php/plano/article/view/176>
- Fransiscus, R., Martua Sihombing, S., & Prima, Y. (2022). ANALISIS TEBAL PERKERASAN LENTUR PADA JALAN TOL AKSES MENUJU BANDARA INTERNATIONAL KERTAJATI. *Jurnal Sipil Krisna*, 8(1), 50–61. <https://doi.org/10.61488/sipilkrisna.v8i1.155>