ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105

International Journal on Recent Researches In Science, Engineering & Technology

Volume 5, Issue 3, March 2017.

A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. It is an absolutely free (No processing charges, No publishing charges etc) Journal Indexed in JIR, DIIF and SJIF.

JIR IF : 2.54
DIIF IF : 1.46
SJIF IF : 1.329

Research Paper
Available online at: www.jrrset.com

An Advanced and Environment Friendly Approach to Produce Electrical Energy Using Human Waste Energy

Dr. P. K. Prakasa
Jeppiaar Engineering College, TN. India

ABSTRACT

The consumption of energy is directly proportional to the progress of mankind. The field of energy conservation is becoming an increasing notable subject of research among the scientific community today. Different methods are proposed already for power generation using non conventional energy sources are solar wind tidal biomass energy fuel cell geothermal energy and human power . Human power is a power produced from gym exercise. Human power can another renewable source of energy. The intention of this paper is to introduce an innovative technique to produce cheap and clean energy. Which is based on renewable energy. Human energy is an alternative source of energy generation and human energy is easily available in human exercise. In this paper through MATLAB Simulink model linear mechanical energy has been converted into electrical energy. Total analysis is based on basic electrical laws and equations.

Key words: Gym Equipment, Linear DC Generator, Rectifiers, Weight, Resistance

INTRODUCTION

Being healthy is always desire of every person. People like fit and attractive body. The presence of hollywood and bollywood has always enhanced the desire to get good body in people [1]. It should be noted that people who go to gym they waste their energy in working against gravity by lifting weight during exercise [4]. This waste energy can utilize with the help of linear dc generator by converting mechanical energy into electrical energy [6]. In this paper with the help of matlab simulink model this waste energy has been converted into electrical energy.

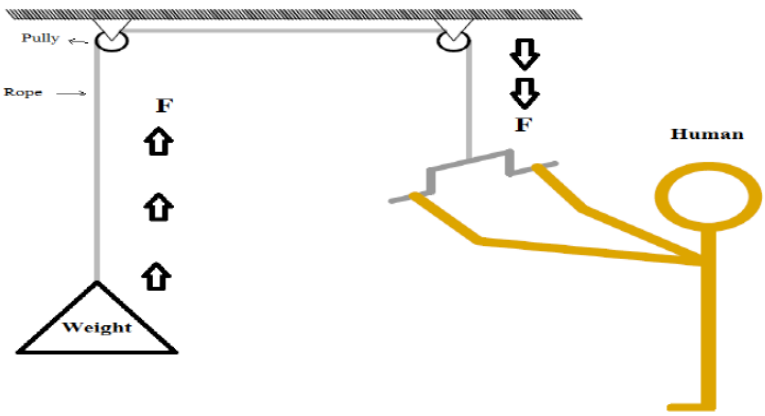

Figure 1

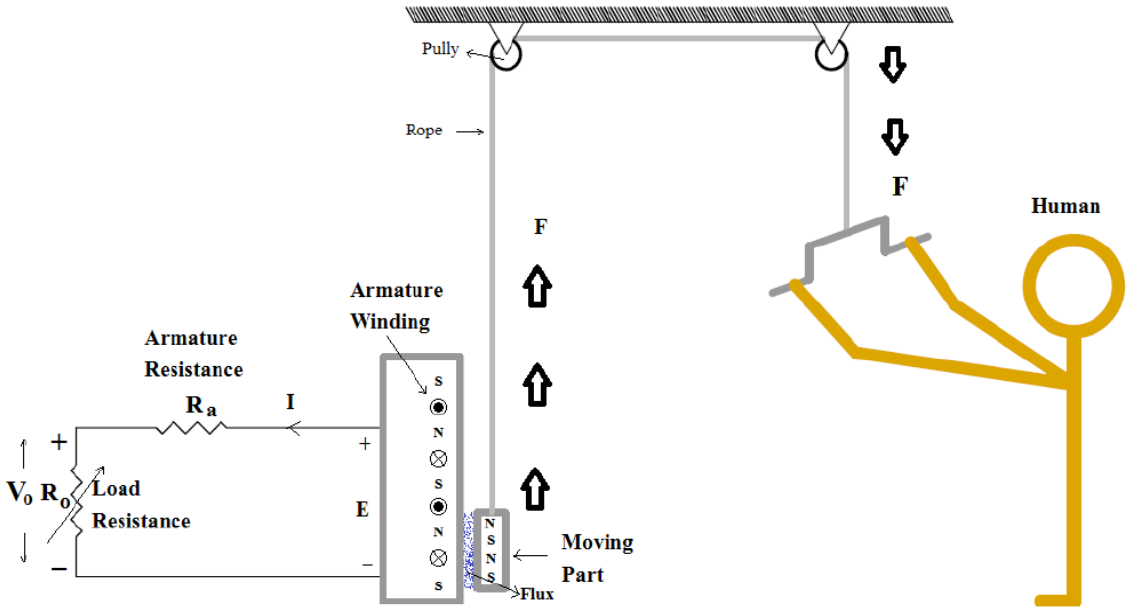

Figure 2

In fig.1 weight is being raised by the person and then the weight is being dropped. And this traditional way muscles are being build up.

Whereas in figure 2 weight is replaced by a translation of dc generator. Generator has two parts. One is stationary and another is moveable. Moving part is being up and down by rope. Moving part is made up of permanent magnet. Stationery part is made up of iron core, in which winding is placed like armature of DC generator. Armature winding is connected to the resistive load through rectifier bridge.

When moving part moves then flux of the permanent magnet link with armature winding of the stationery part, and induces and EMF in it. Since armature winding is connected to load, so current starts flowing through it [5]. As it is shown in figure 2 that how muscles are building without wasting energy.

1.1. Upward motion of moving part

m = actual mass of moving part=10 kg (taken)
mi = effective mass (imaginary) of moving part
Bavg= flux density of PM=0.3wb/m2 (taken)
l = length of conductor=length of coil side=0.5m(taken)
h = Distance covered by moving part in upward motion=1m(taken)
t1 = time taken by moving part in one upward motion = 1sec(taken)
v1 = upward motion's velocity of moving part = h/t1=1/1=1m/sec
a1 = upward motion's accleration = 1m/sec2
F1 = upward force which is applied on moving part
Ra =Armature Resistance
Ro =Load Resistance

{Due to verticle motion friction force will be zero}

{since force = mass*accleration} $\mathbf{F_1 - mg = m.a_1}$ (1)

$mg = 10*9.81 = 98.1N$

By applying this value of force no EMF will induce. Because at this situation whole mechanical energy has consumed in mechanical work.
When value of force is increased beyond **98.1N** then current flows in the circuit and at load. Vo voltage is found for a particular value of load resistance Ro.

$$\text{Mechanical Power} = P_m = F_1 v_1$$

$$\text{Electrical Power} = P_e = E I$$

For proper electromechanical energy conversion $P_m = P_e$

$$F_1 v_1 = E I$$

$F_1 = E I/v_1 = \{(V_o+IR_a)*I\}/v_1 = \{(IR_o+IR_a) I\}/v_1 = I^2(R_o+R_a)/v_1$ { since $E=V_o+IR_a$}

$$\mathbf{F_1 = I^2(R_o+R_a)/v_1} \quad (2)$$

Here v_1 and R_a are constant values. If I becomes constant then

$$\mathbf{F_1 \propto R_o} \quad (3)$$

To keep current (I) constant, the value of force(F_1) will be changed according to R_o. It can be said in this way that if a person during exercise want to change the value of weight (imaginary) then he just has to change the value of resistance (R_o).

effective mass(imaginary) $\mathbf{m_i = (F_1-mg)/a_1}$ (4)

1.2. Downward motion of moving part

t_2 = time taken by moving part in downward motion

v_2 = downward motion's velocity of moving part

F_2 = Force during downward motion=gravitational force

$$F_2 = mg = 10*9.81=98.1N$$

$$h = ut_2 + \tfrac{1}{2} g t_2^2 \Rightarrow 1 = 0*t_2 + .5*9.81*t_2^2 \Rightarrow t_2 = 0.4515\text{sec}$$

$$v_2 = u_2 + g t_2 \Rightarrow v_2 = 0 + 9.81*0.4515 \Rightarrow v_2 = 4.429 \text{ m/sec}$$

In this situation whole mechanical power is wasting in gravity. So no electrical power will produce. To produce electrical power value of t2 must be more than 0.4515 sec.

or t2 > 0.4515 sec

In this paper electrical power generation is considered only through upward motion.

2. MODELLING

There is R2013A version of Matlab simulink software has been used.

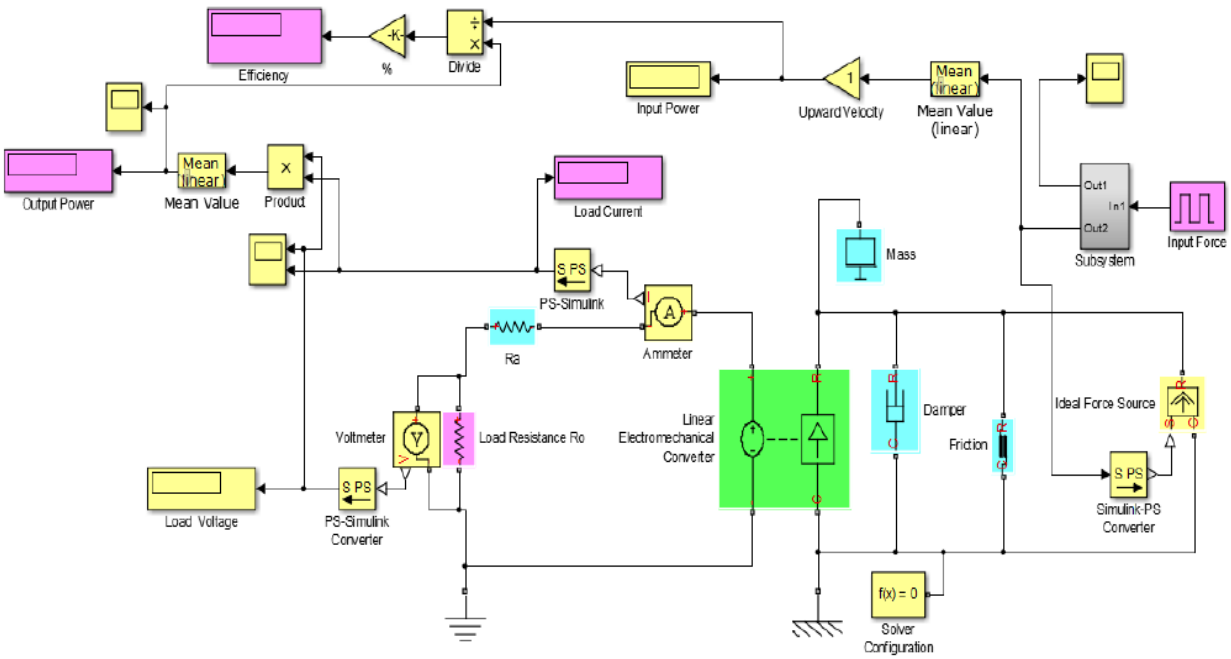

Figure 3 Simulation circuit

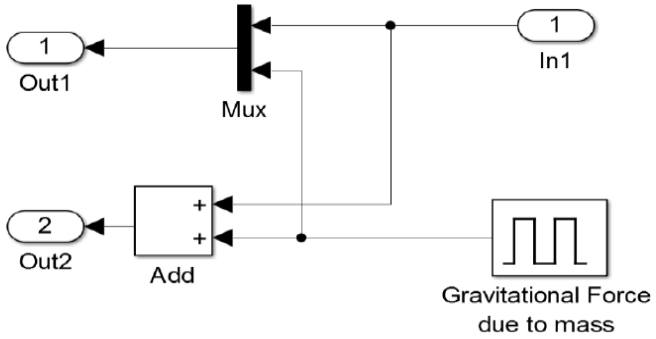

Figure 4

Description of some blocks are given in table 1

Table 1 S no.	**Name of the model block**	**Specification**
1	Linear (Translational) electromechanical energy converter	Constant of proportionality k = 0.3 volt/(m/sec)
2	Armature resistance	Ra = 0.15 ohm
3	Load resistance	Ro = 0.425-6.5 ohm
4	Mass	m =10kg
5	damper (Translational damper)	0.01 N/(m/s)
6	friction (Translational friction)	Fbrk=0.025N, fc=0.02N, f= 1N/(m/s)
7	Mean value	½ Hz
8	Solver configuration	Default
9	applied force (Pulse generator)	Time based, amplitude 108.1-198.1, period 2sec, pulse width 50%, phase delay 0 sec
10	gravitational force Due to mass (Pulse generator)	Time based, amplitude -98.1, period 2sec, pulse width 50%, phase delay 0 sec
11	Gain (upward velocity)	1
12	Gain (%)	100
13	Display (all)	Format short, decimation 1

3. RESULT

In table 2 value of load voltage and load current are calculated for different values of force and load resistance.

Table 2 S No.	**Applied Force F1 (N)**	**Effective Mass mi (kg)**	**Load Resistance Ro (Ω)**	**Load Voltage Vo (Volt)**	**Load Current Io (A)**	**Efficiency (Ƞ)**
1	108.1	10	0.425	0.8903	2.09	48.47
2	118.1	20	1.102	2.303	2.09	61.89
3	128.1	30	1.776	3.713	2.09	66.36
4	138.1	40	2.45	5.123	2.09	68.59
5	148.1	50	3.126	6.534	2.09	69.89
6	158.1	60	3.8	7.944	2.09	70.78
7	168.1	70	4.475	9.354	2.09	71.41
8	178.1	80	5.15	10.76	2.09	71.88
9	188.1	90	5.825	12.17	2.09	72.24
10	198.1	100	6.5	13.58	2.09	72.53

4. CONCLUSION AND FUTURE SCOPE

Human power which was wasting during exercise, now can be saved. This concept can be used as a renewable energy source in future. Because the number of gyms will increase, with the increase of population. It is the idea of such renewable energy that provides good health and also does not harm the environment. Because it is not producing any kind of pollution in the environment. This will also provide some relief to the problem of global warming. Downward motion can also be considered to generate power, through which efficiency of the system will increase. Battery can be charged instead of resistive load. Battery will be charge by applied force.

REFERENCES

[1] Bushra Chalermthai, Nisrein Sada, Omer Sarfraz and Bahaa Radi, "Recovery of Useful Energy from Lost Human Power in Gymnasium," Environment and Electrical Engineering (EEEIC), 2015 IEEE 15th International Conference on , June 2015.
[2] F. O. Antonio, "Wave energy utilization: A review of the technologies, "Renewable Sustain. Energy Rev., vol. 14, no. 3, pp. 899–918, 2010.
[3] Chung-Yang Sue, Nan-Chyuan Tsai, "Human powered MEMS-based energy harvest devices," Applied Energy, vol. 93, pp. 390–403, May 2012.
[4] Rajesh Kumar Datta, Sazid Rahman, "Power Generating Slabs: Lost energy conversion of human locomotive force into electrical energy," International Conference on Electrical and Computer Engineering, pp. 718-721 , Dec. 2014.
[5] Vincent Del Toro, Electrical Engineering Fundamentals, 2nd ed. New York: PHI Learning Private limited, 1986.
[6] Boldea, Syed A. Nasar, Linear Electric Actuators And Generators, 1st ed. New York: Cambridge University Press, 1997.
[7] A.E. Fitzgerald, C. Kingsley, S.D. Umans, Electric Machinery, 6th ed. New York: McGraw-Hill, 2003.
[8] W. X. Zhao, J. Q. Zheng, J. B. Wang, G. H. Liu, J. X. Zhao, and Z. Y. Fang, "Design and analysis of a linear permanent-magnet Vernier machine with improved force density," IEEE Trans. Ind. Electron., vol. 63, no. 4, pp. 2072–2082, Apr. 2016.
[9] G. Cipriani, V. Di Dio, V. Franzitta, A. Russo, M. Trapanese, A. Viola,"A Ferrite Tubular Linear Permanent Magnet Generator (FTLPMG) analysis and design," IEEE, , Sept. 2014.
[10] Jawad Faiz , Alireza Nematsaberi, "Linear electrical generator topologies for direct-drive marine wave energy conversion an overview," IET Renewable Power Generation, Vol. 11, Issue 9, pp. 1163 – 1176, Sep. 2017.
[11] Jinthuja Selvarathinam, Alagan Anpalagan, "Energy harvesting from the human body for biomedical applications," IEEE Potentials, Vol. 35, Issue 6, pp. 6 –12, Nov. 2016.
[12] Mathew Aneke, Meihong Wang, "Energy storage technologies and real life applications – A state of the art review," Applied Energy, vol. 179, pp. 350–377, jun. 2016.
[13] Marco Liserre; Thilo Sauter; John Y. Hung, "Future Energy Systems: Integrating Renewable Energy Sources into the Smart Power Grid Through Industrial Electronics," vol. 4, Issue 1, pp. 18 - 37, March 2010.
[14] M. Leijon, H. Bernhoff, O. Agren, J. Isberg, J. Sundberg, M. Berg, K.E. Karlsson, A. Wolfbrandt, "Multiphysics simulation of wave energy to electric energy conversion by permanent magnet linear generator", IEEE