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Design and Analysis of Train Wheel Power Generation

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ABSTRACT:

As the population increases day by day the demand of energy sources also increasing and due to use of non-renewable energy sources pollution is also increasing.

The availability of them is also limited. So, we need to find alternative sources which can fulfil the requirement of increasing demand i.e. solar, wind, geothermal, tidal, and nuclear. Energy is the necessity for the economic development of our country. Energy exists in different forms in nature but the most important form is electrical energy. Modern society is so much dependent upon the use of electrical energy that it has become a part of our life. Energy is needed as heat, light, motive power etc. The present-day advancement in science and technology has made it possible to convert electrical energy into any desired form. This has given electrical energy a place of pride in the modern world. We can't imagine the world without electricity. The survival of industrial undertakings and our social structures depend primarily upon low cost and uninterrupted supply of electrical energy. Our paper focuses on the generation electricity energy in an innovative and simple manner.

INTRODUCTION:

Over the past few years scientists are working to recover the wasteful electrical energy during regenerative braking. Still now, there is no better way of recovering that wasteful energy.Here we have tapped some amount of energy and converted it into useful electrical energy.

In general, (Indian railway) while entering into the railway station, the speed of the train (irrespective of the type of service) is cut off at FOUL MARK. (It is a point, which is 1200 m away from the station – Indian railway rules). So the train will move only by its moment of inertia. The energy stored in the train cannot be fully recovered by regenerative braking. We are going to tap that wasteful energy and convert it into electrical energy.

This method can be easily understood from the following block diagram. The rotational energy is transferred from the train wheel to the static roller. Then the mechanical energy is stabilized by gearbox and it is fed to the dynamo or generator, which converts the mechanical energy into electricity energy. Then the electrical energy is saved in the battery.

1.1 Block Diagram of Project

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1.2Overall Arrangement:

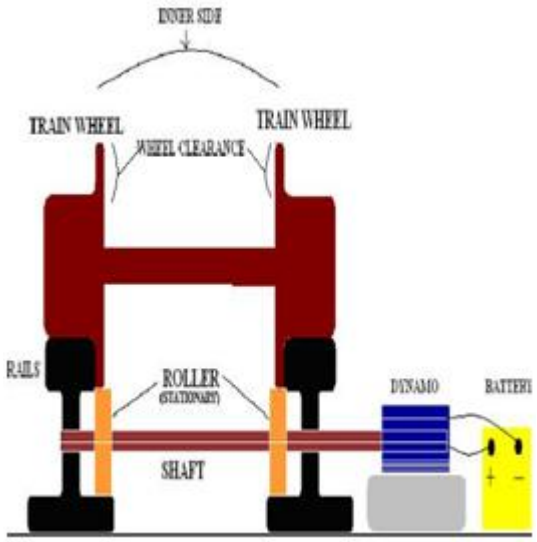

Fig. 1.2 (a) Overall arrangement.

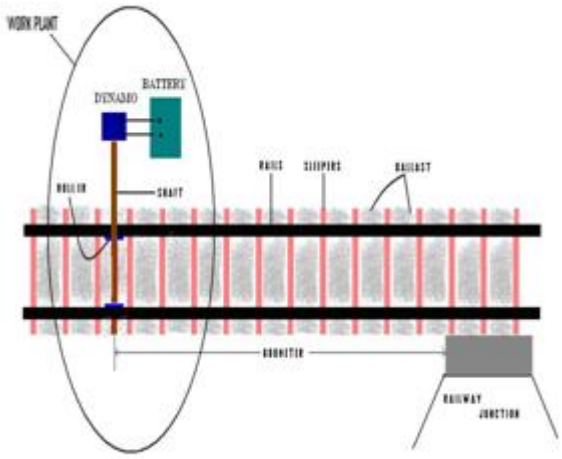

Fig 1.2 (b) Overall arrangement.

Mechanism:

The generation of electrical power mainly basis on the principle of rotational energy.The rotational energy is firstly converted into mechanical energy and then mechanical energy is converted into electrical energy by means of Dynamo.Rotational energy is the simplest form of energy, which can be converted into electrical energy.Most of the electrical energy is mainly generated from rotational energy.All the energy resources can be converted into electrical energy from rotational energy since the alternator used for electrical generation is the rotational machine except solar energy.Consider the two rollers, one is rotating, and another is at rest.Once the rotating roller touches the static roller, some amount of rotational energy is transferred to the static roller.Then the static roller rotates. We can assume that the rotating roller as the train wheel, and the

Working Principle:

The working principle of generating electrical power mainly basis on the principle of rotational energy. Rotational energy is converted into mechanical energy and again electrical energy is converted into electrical energy.

Detailed Operation:

On the inner side of the rails (web), we place a special constructed roller. The roller is coated by a rubber ring, which is used to increase the friction coefficient, between the train wheel and the roller and it decreases the sparking. Initially, the train wheel (clearance) touches the roller, it starts rotating (like initial pulse).Similarly, when the other wheels touch the roller, it rotates continuously. It gives approximately rotation of 2000 rpm. Then the mechanical input is given to the dynamo through gear arrangement. Then the electrical output used for charging the battery. The amount of voltage is depending upon the number of dynamos. Then the output is given to the lead acid battery for charging.

Then the charged battery can use for various applications. A fly wheel is attached to the shaft to compensate the rest time. The flywheel stores energy form the power source during the greater portion of the operating cycle and gives it up during a small period of the cycle. Thus, the energy form the power source to the machines is supplied practically at a constant rate

Dynamo:

Dynamo is an older term used to describe a generator that makes direct current power. The **Stator** is a fixed structure that makes magnetic field, you can do this in a small dynamo using a permanent magnet. Large dynamos require an electromagnet.

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The **Armature** is made of coiled copper windings which rotate inside the magnetic field made by the stator. When the windings move, they cut through the lines of magnetic field. This creates pulses of electric power. The **Commutator** is needed to produce direct current. In direct current power flows in only one direction through a wire, the problem is that the rotating armature in a dynamo reverses current each half turn, so the commutator is a rotary switch that disconnects the power during the reversed current part of the cycle.

CATIA 3D Model of Project:

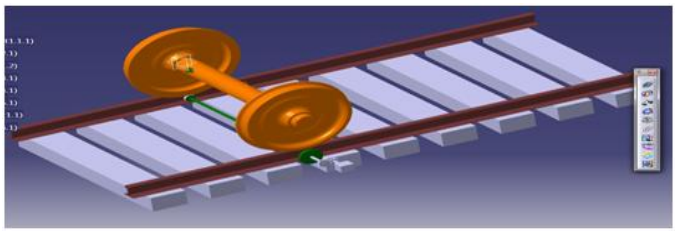

Fig. 1 CATIA Mode

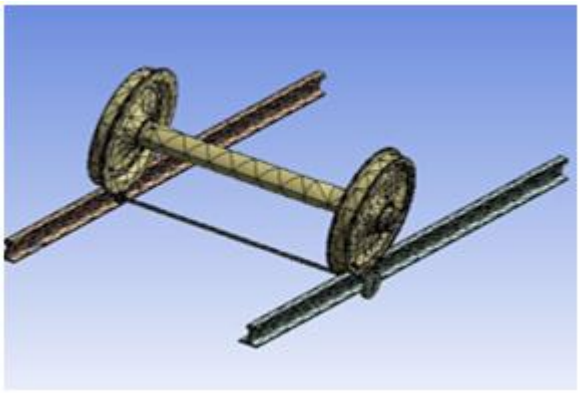

Fig.2 Meshed Model

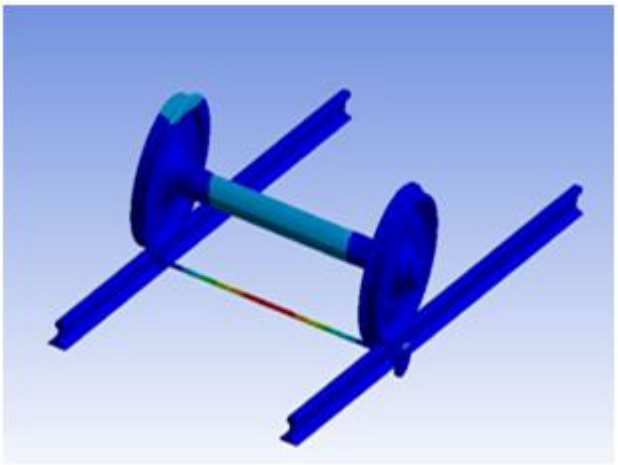

Fig.3 Deformation due to self-weight.

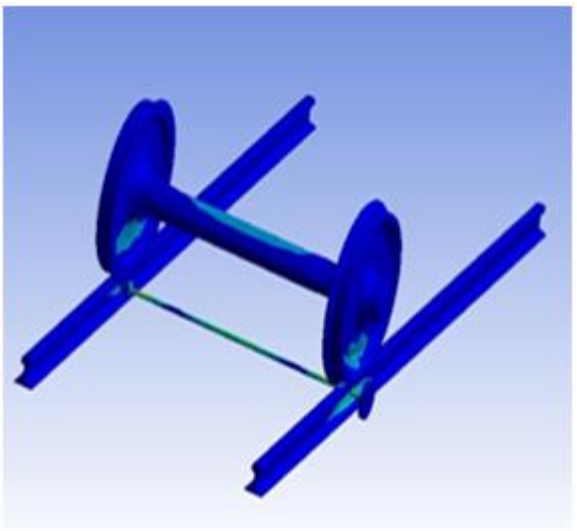

Fig.4 Equivalent stresses.

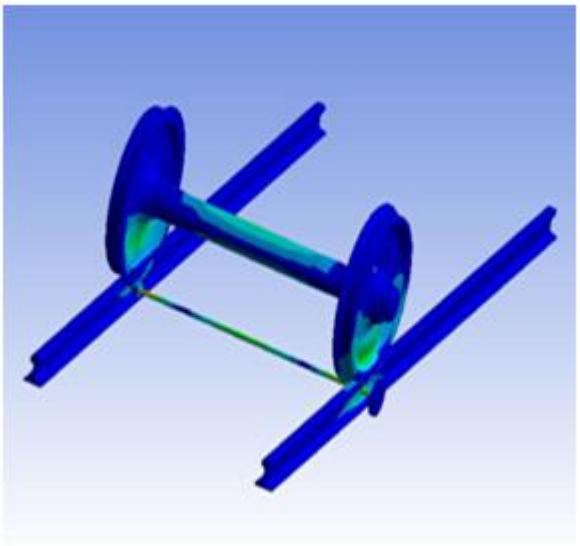

Fig.5 Equivalent Strain.

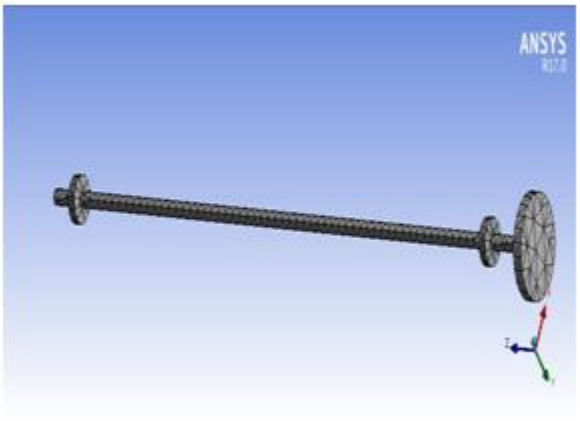

Fig.6 Meshed model of shaft with rollers and flywheel

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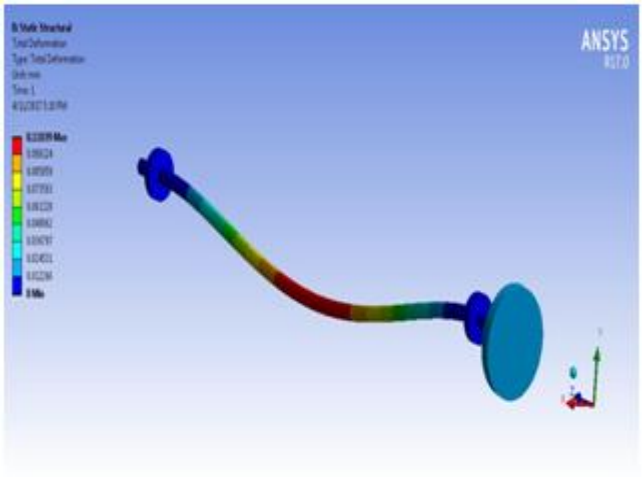

Fig.7 Deformationof shaft with rollers and flywheel

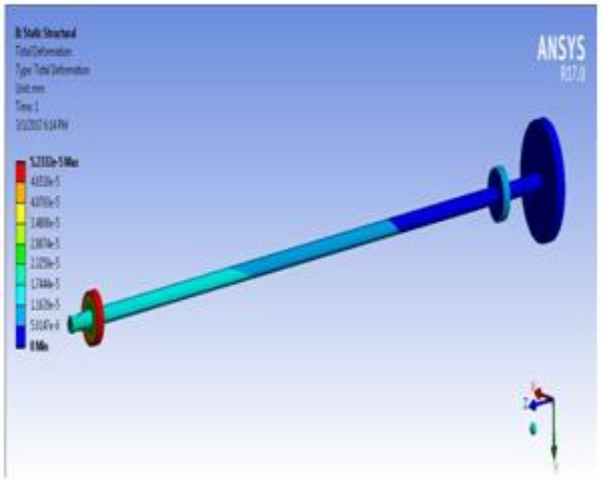

Fig.10 Deformation due to twisting moment

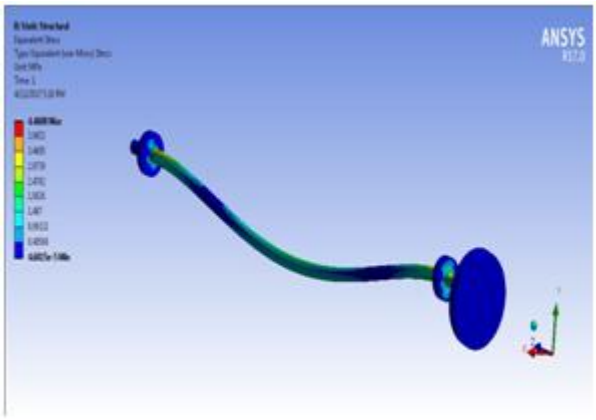

Fig.8 Equivalent stressof shaft with rollers and flywheel

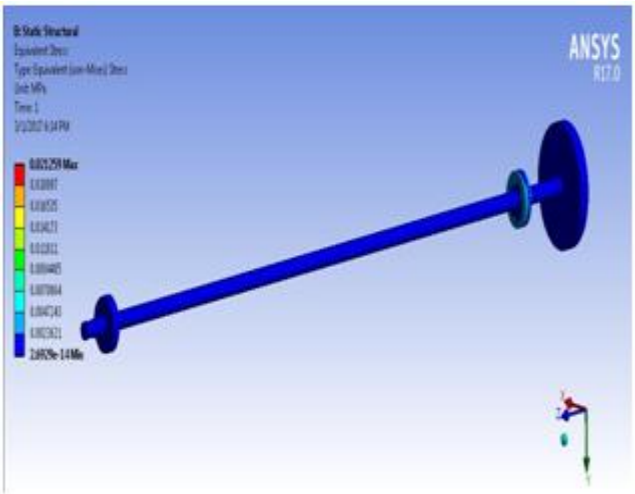

Fig.11 Equivalent stress due to twisting moment

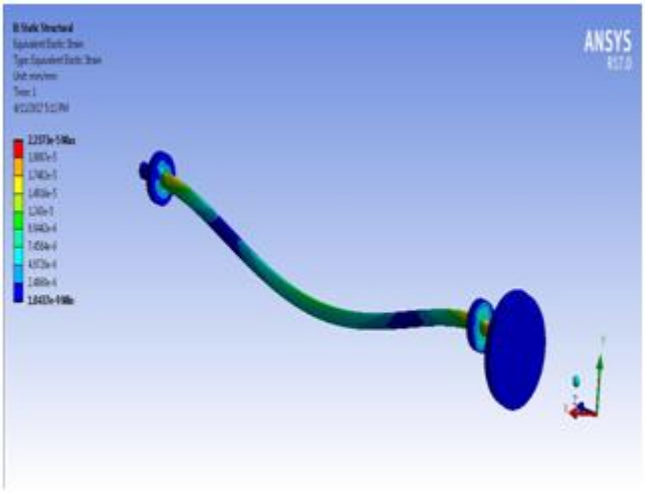

Fig.9 Equivalent strainof shaft with rollers and flywheel

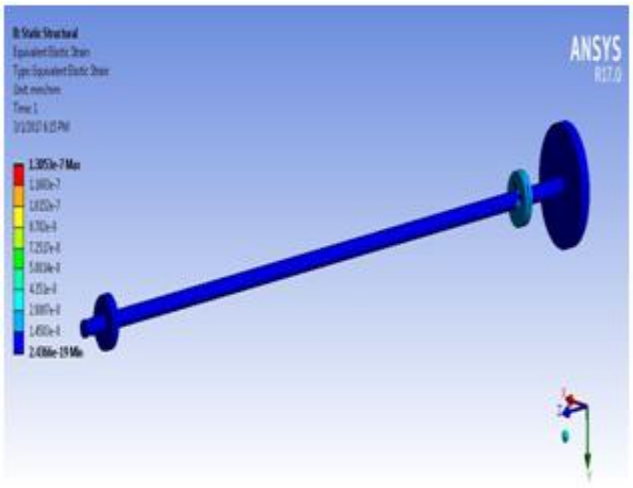

Fig.12 Equivalent strain due to twisting moment

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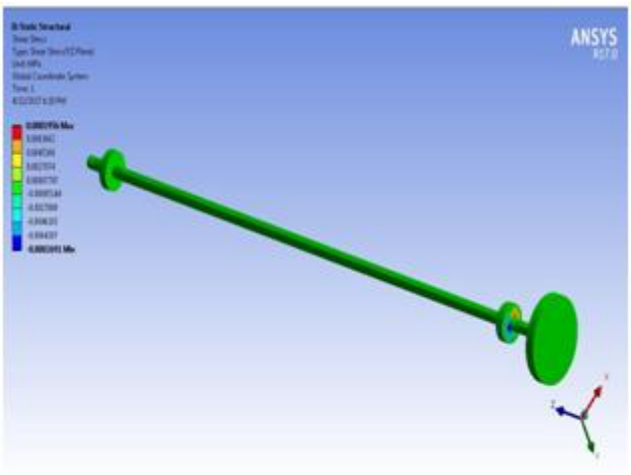

Fig.13 Shear stress due to twisting moment

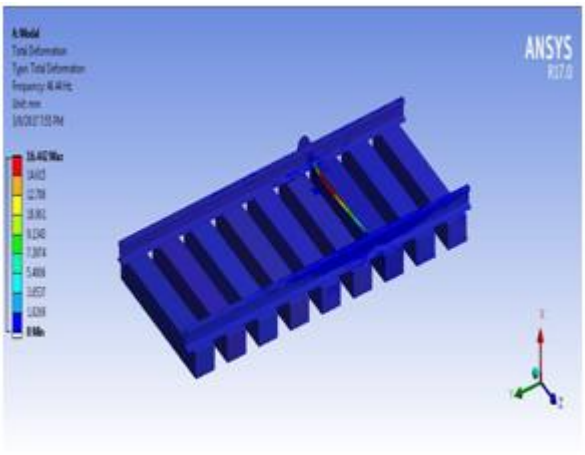

Fig.14 Deformation due to vibrations at 46 Hz frequency.

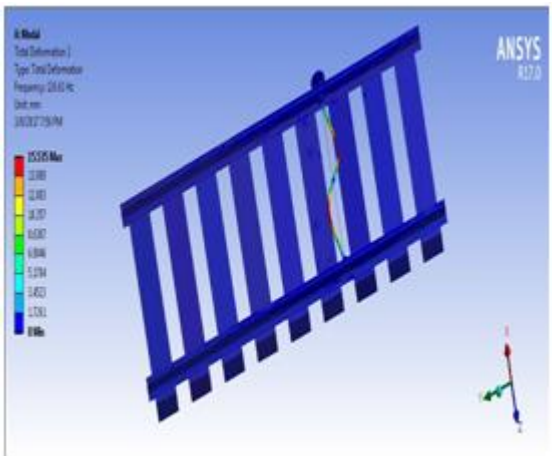

Fig.15 Deformation due to vibrations at 126 Hz frequency.

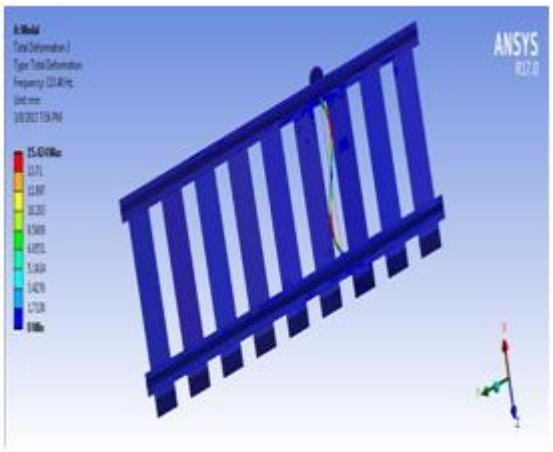

Fig.16 Deformation due to vibrations at 133 Hz frequency.

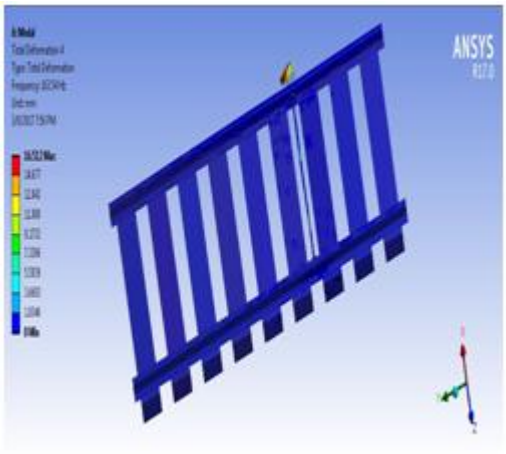

Fig.17 Deformation due to vibrations at 163 Hz frequency.

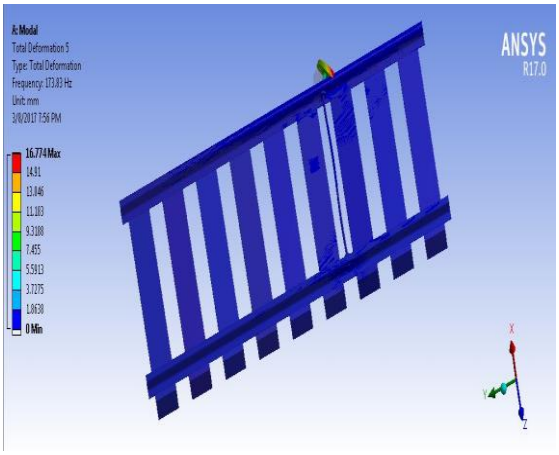

Fig.18 Deformation due to vibrations at 173 Hz frequency.

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6.10 Analysis of Gears:

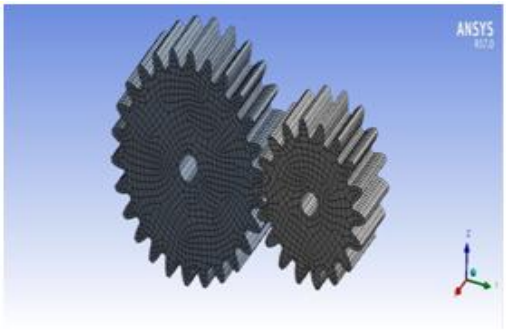

Fig.19 Meshed model of gear & pinion

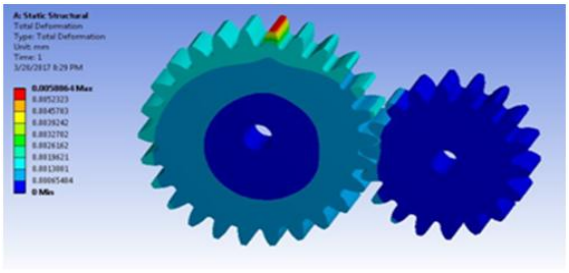

Fig.20 Deformation of gear & pinion

RESULTS:

"Design and Analysis of Train Wheel Power Generation" project is designed and analysed using CATIA V5 R16 and ANSYS 17.0 software's. A safer design is obtained using controlled and optimum results. The analysis results of the project are as follows.

Table No. 8.1: Static Structural Analysis Results:

S.No	Component	Deformation (mm)	Equivalent Stress (N/mm^2)	Equivalent Strain (mm/mm)	Shear Stress (N/mm^2)
1.	Complete parts	0.10935	3.7622	1.9269×10^{-5}	-------
2.	Shaft with rollers and flywheel	0.11039	4.4608	2.2373×10^{-5}	------
3.	Twisting moment for Shaft with rollers and flywheel	5.2322×10^{-5}	0.021259	1.3053×10^{-7}	------
4.	Shear stress for Shaft with rollers and flywheel	------	------	------	0.0081956
5.	Gear & pinion	0.005884	22.989	0.0001111	---------

Table No. 8.2: Vibration Analysis results:

S.No	Component	Deformation (mm)				
		At Frequency 40 Hz	At Frequency 126 Hz	At Frequency 133 Hz	At Frequency 163 Hz	At Frequency 173 Hz
1.	Railway Track with shaft and rollers	16.442	15.535	15.424	16.512	16.774

CONCLUSION:

We can use this electrical power as a free service in railway station like water service. The Fabrication cost for this arrangement will be very less approximately Rs. 15, 000/-. So the government can easily implement this arrangement. No need of experts to implement this method at railway station even line man can easily understood the methodology. We hope this method can be easily adopted in the modern world. Our former president Dr. A.P.J. Abdul Kalam said," All the Engineers would find alternatives to generate the electricity by saving the energy resources and utilizing the things like wind energy, solar energy etc." Our kind request is, as an engineer we have to do something for our nation.

FUTURE SCOPE

By putting more unit in that foul mark point, we can generate more amount of energy in minimum cost. This facility will be more economical and attractable in heavy traffic cities like Delhi, Chennai, and Mumbai.

REFERENCES:

1. S.Mukunthan, Department of Mechanical, IFET College of Engineering, Villipuram, Chennai. Submitted Train Wheel Electricity Power Generation journal paper.
2. V.B. Bhandari, "Design of Machine Elements" McGraw Hill Education, New Delhi, 3rd edition 2015. For Spur Gear Design Calculations.
3. **ANSYS,** INC. Theory reference
4. Satish Chandra, M.M. Agarwal "Railway Engineering" OXFORD University Press, New Delhi. Theory and drawing reference
5. www.coregravity.com,for Dynamo, power vs speed calculations reference.
6. www.wheelsworld.com, for Train wheel drawing referenc.