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Free Energy Generation Using Flywheel

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ABSTRACT

The increasing demand for sustainable and renewable energy sources has driven research into unconventional energy generation methods. This project explores the concept of free energy generation using a **flywheel energy storage system** (FESS). A flywheel is a mechanical device that stores rotational energy and can be used to generate electricity by converting kinetic energy into electrical energy through a generator. The system involves an initial input of energy to rotate the flywheel, after which the inertia of the spinning mass maintains motion, minimizing further energy input. By integrating a motor-generator system and utilizing efficient bearings to reduce friction losses, the flywheel can act as a temporary power source or energy buffer.

While the concept of "free energy" is often misinterpreted in violation of the laws of thermodynamics, this study focuses on **energy recovery and efficient storage** rather than perpetual motion. The flywheel system can harness surplus or regenerative energy (e.g., from braking in vehicles or solar/wind intermittency), store it mechanically, and release it when needed, thereby improving overall energy efficiency. This abstract reviews the working principle, potential applications, advantages, and limitations of flywheel-based energy systems and proposes a prototype design for small-scale sustainable power generation.

INTRODUCTION

The concept of free energy generation has intrigued scientists, engineers, and enthusiasts for centuries. Among the various mechanical approaches explored, the use of a **flywheel** stands out as a promising method for energy storage and management. A flywheel is a mechanical device specifically designed to efficiently store rotational energy. When integrated into an energy system, it can absorb excess energy when available, store it as kinetic energy, and release it when needed, thereby maintaining energy balance and improving efficiency..

In theory, some have proposed the idea of using a flywheel to generate "free energy" — energy that is produced with minimal or no continuous external input. This typically involves a setup where a motor spins a heavy flywheel, which in turn drives a generator. Once the flywheel reaches a high rotational speed, it maintains momentum due to inertia, potentially allowing energy extraction over time. Proponents suggest that the system However, in practical terms, the idea of "free energy" violates the **law of conservation of energy** and **thermodynamics**, which state that energy cannot be created or destroyed. Losses due to friction, air resistance, and mechanical inefficiencies make true perpetual or free energy generation unfeasible. Despite this, flywheels remain highly valuable in energy storage systems, especially in modern applications such as uninterruptible power supplies (UPS), hybrid vehicles, and renewable energy systems, where they help balance supply and demand.

This paper explores the principles behind flywheel energy systems, their practical applications, and the limitations that prevent them from serving as true sources of free energy, while acknowledging their usefulness in enhancing overall energy efficiency.

LITERATUREREVIEW

1. Xiaojun Li, Alan Palazzolo (2021)This comprehensive review examines recent progress in flywheel energy storage systems (FESS), focusing on interdisciplinary advances across design, materials, subsystems, performance, and emerging applications—especially grid-scale and renewable energy integration. It also outlines future opportunities for FESS development. arXivResearchGate

2. "Modeling flywheel energy storage system charge and discharge dynamics"

Authors: Pieter-Jan C. Stas, Sulav Ghimire, Henni Ouerdane (2020)This work addresses mechanical stresses in flywheel rotors (solid vs. hollow designs) and develops mathematical models for coupled mechanical–electrical behavior during charge and discharge, with detailed analysis of system dynamics. Useful for understanding stress limits and performance under different operational scenarios. arXiv

3. "Analysis and optimization of a novel energy storage flywheel for improved energy capacity"

Authors: Xiaojun Li, Alan Palazzolo (2022)Building on their earlier review, the authors optimize flywheel designs with improved energy density. Notably, a shaftless flywheel concept that doubles energy density and uses FEA to integrate magnetic bearings and motor/generator considerations is proposed. arXiv

4. Critical Literature Reviews and Technology Overviews

- **"Critical Review of Flywheel Energy Storage System"** provides an in-depth look at component materials (steel vs. composite floors), machine types (PMSM, induction, BLDC, SRM, etc.), and their suitability across applications. MDPI
- **"A Review of Flywheel Energy Storage System Technologies and Their Applications"** (Amiryar & Pullen, 2017) delivers a structured analysis of FESS structures, components, converter topologies, and commercial prototypes, with critical insights into key market segments.

5. Material & Structural Considerations

"A review of stress analysis on materials and structures for flywheel energy storage systems" focuses on rotor designs, comparing metallic and composite materials. It highlights the pivotal role of rotor geometry and material properties in achieving high energy density safely. EWA Direct

6. Application-Specific Insights

"A Review of the Application and Development of Flywheel Energy Storage" examines flywheels in transit systems, particularly in rail. It underscores composite materials like T1000 fiber/resin for their superior power-to-mass ratios and forecasts applications in grid regulation and UPS systems. Darcy & Roy Press

7. Experimentation on "Free Energy" Concepts

A few papers — primarily from conference proceedings or regional journals — explore self-sustaining or over-unity claims using flywheels and mechanical linkages. For instance:

- **"Free Energy Generation Using Flywheel"** (Kattimani & Inayath, 2019) describes a setup where a 2 HP motor drives a flywheel-gear alternator system, claiming greater electrical output than input. However, these setups typically contradict thermodynamic principles and lack rigorous validation. IJSRST
- **"Generation of Free Energy using a Compact Flywheel"** (2022 conference paper) simulates a compact flywheel-actuated generator with magnetic levitation and feedback loops, yet remains

speculative without experimental corroboration. ResearchGate

These "free energy" assertions conflict with the First and Second Laws of Thermodynamics and should be approached critically unless thoroughly peer-revie

DESIGNING AND CALCULATION

Design-Oriented Research Papers & Projects

1. Design and Fabrication of Free Fly Wheel Power Generation

- **Authors**: B. Sairamkrishna et al. (2025)
- **Summary**: This experimental project aims to construct a "self-sustaining" flywheel mechanism that, after an initial mechanical input, is intended to keep rotating and generating electricity—ideally powering its own motor. The system involves a motor driving a flywheel via pulley and belt, with the flywheel powering an alternator to produce electricity, which supposedly loops back to run the motor.
- **Critique**: The authors acknowledge the concept conflicts with thermodynamic principles. While it may serve as an engaging educational model, the design cannot sustain continuous energy output due to inevitable losses from friction, air resistance, and inefficiencies in conversion.
- **Reference**: IJRASET

2. Design of Flywheel Energy Generation System

- **Authors**: Giridhar S Nagali et al.
- **Summary**: This paper describes a traditional flywheel energy system design—spinning a large-inertia flywheel to store kinetic energy, then converting it into electricity via a generator. The process includes charging (spinning up) and discharging (energy extraction)—employing tried-and-tested engineering principles.
- **Note**: It does not claim "free energy" but focuses on practical energy storage and conversion for power generation.
- **Reference**: iaesprime.comiaesprime.com

3. Design and Analysis of an Integrated Flywheel, Motor/Generator, and Magnetic Bearing Configuration

- **Summary**: This study presents a refined flywheel design integrating composite rotors with magnetic bearings and motor/generator systems. Using one-dimensional finite element modeling, it analyzes dynamic behavior, including natural frequencies and critical speeds—key to avoiding resonance and ensuring mechanical stability.
- **Insight**: It offers a solid, engineering-focused approach to flywheel design—optimizing for stress resilience, control, and safe operation, rather than any perpetual motion.
- **Reference**: ResearchGate

4. Analysis and Optimization of a Novel Energy Storage Flywheel for Improved Energy Capacity

- **Authors**: Xiaojun Li & Alan Palazzolo (2022)
- **Summary**: This paper focuses on enhancing flywheel system energy density by optimizing rotor design. It compares conventional shafted designs with a novel **shaftless flywheel**, showing that eliminating the shaft can **double energy density**. The design is further refined using finite element analysis (FEA), considering magnetic bearings and motor/generator integration.
- **Relevance**: It highlights modern design innovations aimed at maximizing storage performance while ensuring mechanical and electromagnetic compatibility.

- **Reference**: arXiv

5. Modeling Flywheel Energy Storage System Charge and Discharge Dynamics

- **Authors**: Pieter-Jan C Stas, Sulav Ghimire, Henni Ouerdane (2020)
- **Summary**: This paper develops mathematical models that cover both mechanical and electrical dynamics during charging and discharging phases. It covers stress analysis for rotor geometries (solid and hollow disks) and models how mechanical and electrical subsystems interface—providing design guidelines for system stability and performance under dynamic conditions.
- **Contribution**: Offers theoretical underpinning vital for robust flywheel design, ensuring safety and efficiency under real-world operational scenarios.
- **Reference**: arXiv

6. Research on Energy Storage Flywheel Controller Array

- **Authors**: Lili Jing & Yongsheng Dong
- **Summary**: Focuses on the control architecture necessary when deploying multiple flywheel units. It explores how controller arrays can synchronize operations, manage load distribution, and optimize energy dispatch—especially important for grid-scale or multi-module flywheel systems. Simulations and experimental data underpin the design recommendations.
- **Reference**: Darcy & Roy Press

7. Lab-Scale Flywheel Energy Storage System: Control Strategy and Domestic Applications

- **Journal**: MDPI Energies
- **Summary**: Presents a lab-scale prototype using a permanent magnet synchronous machine (PMSM) for flywheel charge and discharge. The paper discusses control strategies, efficiency, and potential use cases like peak shaving and UPS functionality in residential settings.
- **Design Note**: Highlights real-world applicability and operational behavior under grid loss or load variation—emphasizing that, while promising, the system's autonomy is limited (seconds to minutes), not perpetual.

Calculation

For V-Belt ,θ= 40,μ= 0.2

$$\alpha = 180 - 2x\sin^{-1}\frac{d_2 - d_1}{2c}$$

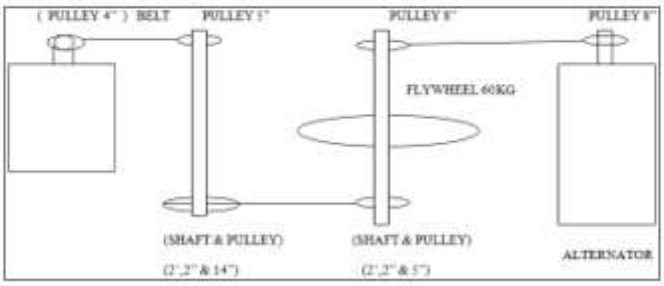

Fig.3.1LineDiagram

Consideredinputdata

Power P=2HP=1.419kW

N_1=Speed of driver pulley=1440rpm

d diameter of driven pulley=203.2mm

Flywheel diameter=2ft=609.6mm

Mass of the flywheel=60kg

d_2=diameter of driver pulley=101.6mm

1) SHATFDESIGN

Yield stress σ_y=250N/mm2,Length of the shaft L=609.6mm,

Density of mild steel ρ =1.491kw

$$\tau_{max} = \frac{0.5\sigma_y}{fos} = \frac{0.5X250}{3} = 41.66 N/mm^2$$

$$\text{Torque} = \mathbf{M_t} = \frac{60X10^6XKW}{2\pi n} = \frac{60X10^6X1.491}{2\pi X720}$$

$$\mathbf{M_t} = 19772.43Nmm$$

Bending Moment

For pulley1:

$(P_1 - P_2)Xd_1 = M_t$

$(P_1 - P_2)X101.6 = 19772.43$

$P_1 - P_2 = 194.67$

$P_1 - P = e^{\frac{\mu\alpha}{\sin\frac{\theta}{2}}}$

$C = (d_1 + d_2) + 100 = 101.6 + 203.2 + 100$

$C = 404.8$

$\alpha = 180 - 2\sin^{-1}\frac{203.2-101.6}{2X404.8}$

$\alpha = 172.77$

$\frac{P_1}{P_2} = e^{\frac{0.2X172.77}{\sin 20}} = 2.203$

$\mathbf{P_1 = 356N}$

$\mathbf{P_2 = 161.82N}$

$P_1 + P_2 + W = 356 + 161.82 + 0.9x81 = 527.20$

$M_A = 637.65x204.8 - 527.20x100$

$= 130590.72 - 52720$

$\mathbf{M_A = 77870.72Nmm}$

Pulley2:

$(P_1 - P_2)X177.8 = 19772.43$ $P_1 - P_2 = 111.206$

$\alpha = 180.2x\sin^{-1}\frac{345.6X6X101.6}{2X556}$

$\alpha = 154.95$

$\frac{P_1}{P_2} = e^{0.2X\frac{154}{\sin 20}} = 2.223$

$P_1 = 2.223P_2$

$1.223P_2 = 111.206$

$\mathbf{P_1 = 202.134N}$

$\mathbf{P_2=90.92N}$

$=P_1+P_2+W=90.92+202.134+0.9X9.81$

$=301.883N$

$M_B=637.65X204.81-301.883X100$

$M_B=130590.72-30188.3$

$M_B=100402.42Nmm$

$\tau_{max}=\frac{16}{\pi d^3}\sqrt{(100402.42)^2+(19772.43)^2}$

$d^3=\frac{16}{\pi X41.66}\sqrt{(100402.42)^2+(19772.43)^2}$

$=\frac{16}{\pi X41.66}\sqrt{(10471594930)}$

$=\frac{39301.319}{\pi}=12508.377$

d=23.213mm

For safe operation with considering vibration parameter 2inch diameter shaft is selected.

d=50.8mm

2) SelectionofbearingSpee dofshaftN$_2$=720rpmL$_{10h}$=20 000

$P(P_1+P_2+W_1)=527.2N$

Bearing Life

$L_{10}=\frac{60xnx40h}{10^6}=\frac{60x720\ x\ 20000}{10^6}$

$L_{10}=864$

Dynamic Load Capacity

$C=P(L_{10})^{\frac{1}{3}}=527.2X(864)^{\frac{1}{3}}$

C=5021.26N

50BC02or55BC02

Selected as:$C_{50}=27070$ N,$C_{55}=33340$ N

SimilarlyBearing2:P=301.883N

$L_{10}=\frac{60XnX40h}{10^6}=\frac{60x\ 720\ x\ 20000}{10^6}=864$

$C=301.883x(864)^{\frac{1}{3}}$

C=2875.25N

A s per standard bearing capacity

C Bearing No. Ford=50.8mm

3) Belt Drive

For the first two pulleys

For the first two pulleys

Weknowthat $\frac{d_2}{d_1}=\frac{N_1}{N_2}$ $\frac{203.2}{101.6}=\frac{1440}{N_2}$

N_2=720rpm

Now Select Correction Factor According To Service

For System From Design Data Book F_a= 1.2

Design power P_d=service factor X power obe

transmitted

$$=1.2x1.491$$

$$P_d=1.7892kW$$

We select the v-belt type according to power transmission, we select as 'B' type V-belt from the design data book

Normal thickness t(mm)=11mm

Width=17mm

Velocity=25m/sec

Max .no of strands=9

Assume centre distance between two pulleys

$$C=d_1+d_2+100 = 203.2+101.6+100 = 404.8mm$$

C=405mm

Now we find the length of the belt used for drive

$$L=2C+\frac{\pi(d_1+d_2)}{2}+\frac{(d_2-d_1)^2}{4C}$$

$$=2x405+\pi\frac{(203.2+101.6)}{2}+\frac{(203.2-101.6)^2}{4x405}$$

$$L=810+478.84+L\ \frac{(101.6)^2}{1620}$$

=1295.211mm

L_p=1491mm

Selected Btype57

$$1491=2C+\pi\frac{(203.2+101.6)}{2}+\frac{(203.2-101.6)^2}{4xC}$$

$$1012.16=2C\ \frac{(101.6)^2}{4C}=2C+\frac{2580.64}{C}$$

$1012.16C=2c^2+2580.64$

$F_c=k_c$ =Correction factor for belt pitch length for system from table =0.88

Are

$$\alpha=180-2x\sin^{-1}\frac{d_2-d_1}{2C}$$

$$=180-2x\sin^{-1}\frac{202.2-101.6}{2}$$

4) Flywheel

$K.E=\frac{1}{2}IW^2$

Input Rpm to Wheel

$\frac{N_1}{}=\frac{d_2}{d_1}=\frac{1440}{N_2}=\frac{5N_2}{4}$

$N_2=1152rpm$

$\frac{N_3}{N_4}=\frac{d_4}{d_3}=\frac{1152}{N_4}=\frac{5}{16}$

$N_4=3686.4$

K=0.9flywheelwithrim/rib

m=60kg

$I=Kmr^2$

$I=0.9\times60\times9.81\times 0.3048^2$

$I=49.214Kg\text{-}m^2$

$w=\frac{2\pi n}{60}=\frac{2\times\pi\times3686.4}{60}=386.038$

$W^2=149025.337rad/sec$

$K.E=\frac{1}{2}\times 49.214\times 149025.337$

K.E=3667066.468N-M

WORKINGPRINCIPLEANDCOMPONENTUSED

The concept of free energy generation using a flywheel is based on the idea of converting an initial input of electrical or mechanical energy into rotational kinetic energy, which is stored in a heavy, spinning flywheel. Once the flywheel reaches a certain speed, its inertia allows it to continue rotating even after the input energy is reduced or removed. This stored rotational energy can then be used to drive a generator, producing electrical power. In some proposed designs, part of the generated electricity is fed back into the motor to maintain the flywheel's rotation, while the remaining energy is used to power external loads. This creates the appearance of a self-sustaining system. However, in practice, due to inevitable losses from friction, air resistance, and electrical inefficiencies, the system gradually loses energy and requires additional input to maintain operation. Therefore, while flywheels are effective for short-term energy storage and power smoothing applications, the idea of perpetual or free energy generation from a flywheel is not scientifically valid according to the laws of thermodynamics.

Fig.4.1.1AssembledModel

A. Components Used

The working of an AC motor is based on **Faraday's Law of Electromagnetic Induction** and the **Lorentz Force**. When alternating current flows through the stator winding, it creates a **rotating magnetic field**. This rotating magnetic field induces a current in the rotor, which then produces a torque, causing the rotor to rotate..

TABLE

SPECIFICATIONS OF AC MOTOR

S. No	Specifications	Units
1	2	kW
2	2	HP
3	1500	RPM
4	200/230	Volts
5	2	Phase
6	13	AMP

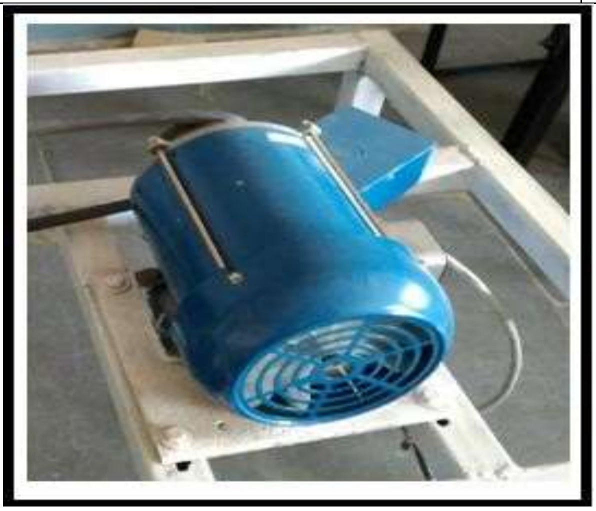

Fig.4.2.1ACmotor

Alternator: An **alternator** is a type of electrical generator that converts mechanical energy into **alternating current (AC) electrical energy**. In a flywheel-based energy generation system, the alternator plays a crucial role by converting the rotational kinetic energy stored in the spinning flywheel into usable electrical power.

Flywheel: The **flywheel** is the central component in any flywheel-based energy system. It is a heavy rotating disc that stores **mechanical energy** in the form of **rotational kinetic energy**. The fundamental idea behind using a flywheel for energy generation is to harness this stored energy to produce electrical power.

Fig.4.2.3Flywheel

Shaft: The **shaft** is a critical mechanical component in a flywheel-based energy generation system. It serves as the **main rotating axis** that connects the flywheel to both the motor (which spins the flywheel) and the generator or alternator (which converts the flywheel's mechanical energy into electrical energy)..

Fig.4.2.4Shaft

Pulley: The **pulley** is an important mechanical component used in flywheel-based energy systems to **transmit rotational motion** between the motor, flywheel, and generator shafts, especially when these components are not directly coupled.

Fig.4.2.6Belt

Structural frame: Structural frame is used to transmit the loads and vibrations of rotating members to ground .C-Chanel frame of 2inch thickness,6ft length and 3ft width is used to carry all the components. Figure shows the fabricated model of C frame structure.

Fig.4.2.8JournalBearings

FABRICATION

A.Boring

In machining boring is the process of enlarging a hole that has already been drilled or cast by means of a single –point cutting tool or of a boring head containing several tools .A hole of 2 inch diameter is bored in 4 pulleys and other 2 pulleys are bored with a diameter of 1 incht of ixthese pulleys on shaft.

Fig.5.1.1Boringofpulley

Fig.5.2.1KeyWayonShaft

A. MIG Welding

MIG welding stands for **Metal Inert Gas Welding**, also known as **Gas Metal Arc Welding (GMAW)**. It is one of the most widely used welding processes for joining metals, especially in fabrication, automotive, and manufacturing industries.

Fig.5.3.1MIGWelding

Drilling

Fig.5.4.1DrillingofC-Chanel

Cutting

Cutting is the separation of a physical object , into two or more portions ,through the application of an acutely directed force .On cutting machine two C-Channels of 20 ft each are cut into 6 different length s in which 4 are of 6 ft and 2 are 3ft.

Fig.5.5.1CuttingofC-Chanel

Fitting refers to the process of **assembling and aligning mechanical parts** so that they work together smoothly and securely. In a flywheel-based energy generation system, **accurate and strong fitting** of components is crucial for ensuring mechanical efficiency, minimizing energy losses, and preventing mechanical failures.

Drilling is a fundamental mechanical operation used to create **precise holes** in metal or other materials. In a flywheel-based energy generation system, drilling is an essential part of the **fabrication and assembly process**, enabling accurate fitting of components like the **flywheel, shaft, pulleys, bearings, and frame**.

Fig.5.6.1AssembledModelT

ABLEIII.TESTING

S. No	Specimen	Speed(RPM)
1	SpeedofShaft1N_2=N_3	1300
2	SpeedofFlywheelN_4	2100
3	Speed of Generator	1650

$$K.E=\frac{1}{2}IW^2$$

$$I=Kmr^2$$

$$I=0.9\times60\times9.81\times0.3048^2$$

$$I=49.214Kg\text{-}m^2$$

$$w=\frac{2\pi N4}{60}=\frac{2\times\pi\times}{60}=230.38$$

$$W^2=53074.944rad/sec$$

$$K.E=\frac{1}{2}\times 49.214\times53074.944$$

$$K.E=1306015.147N\text{-}M$$ Testing

CONCLUSION

Energy stored in the flywheel through 2HP motor has been utilized to run the generator to produce electricity for running of 2HP motor and remaining energy to utilize for other electric equipments. Hence through this methods free energy has been utilized for domestic purpose.

TheothermainadvantageofConventionalFreeenergyusingflywheelisthatitcangenerateenergywithoutextraequipmentandthisfreeenergygenerationisnonhazardousandenvironmentalfriendly.Canbeuseinvariousapplicationslikeelectricfuelcars,andincreasetheefficiencyoftraditional electrical Equipment's

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