

Evaluation of the effect of using magnetic gear in improving the performance of process systems based on mechanical gear

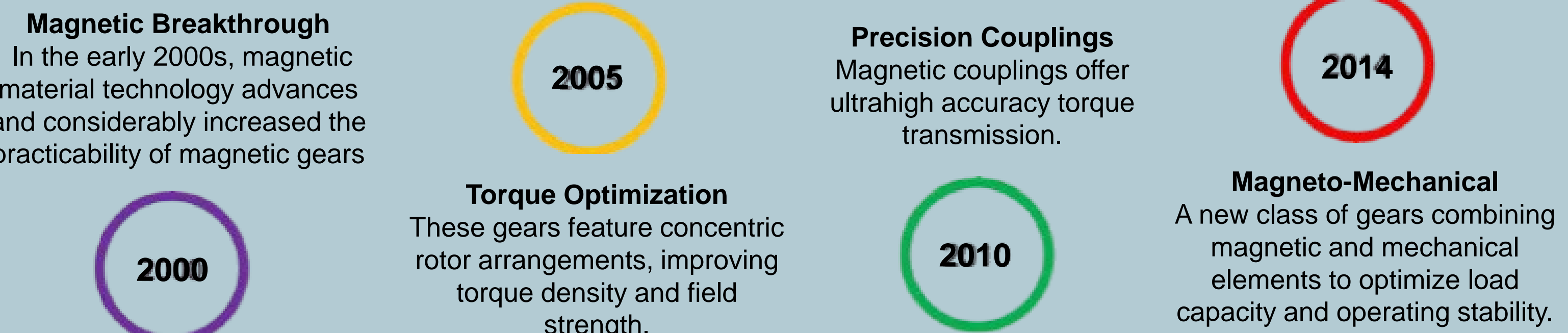


Authors : Artin Radmatin, Ava Alebouyeh, Baran Bahman , Elyar Ferdosizadeh, Mohammad Hossein Ezzati, Supervisor : Mohammad Arjmand

Introduction

Mechanical gear systems are prone to wear, noise, and backlash—limiting performance, efficiency, and reliability in precision-critical industrial processes.

Past experiences (Magnetic gear trials):



Idea Description and Objectives :

The **New Magnetic Gear System** introduces contactless transmission technology founded on optimized magnetic coupling. It aims to offer accurate, efficient, and low-maintenance , torque transfer—optimized for industrial conditions calling for clean operation, dynamic stability, and long-term mechanical strength.

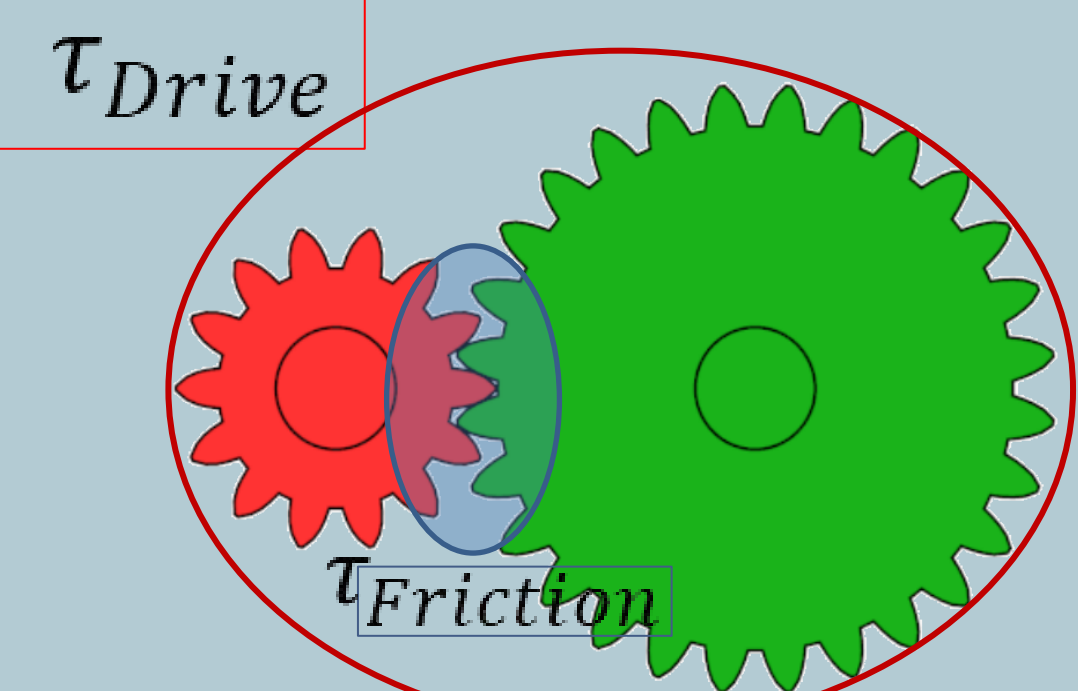
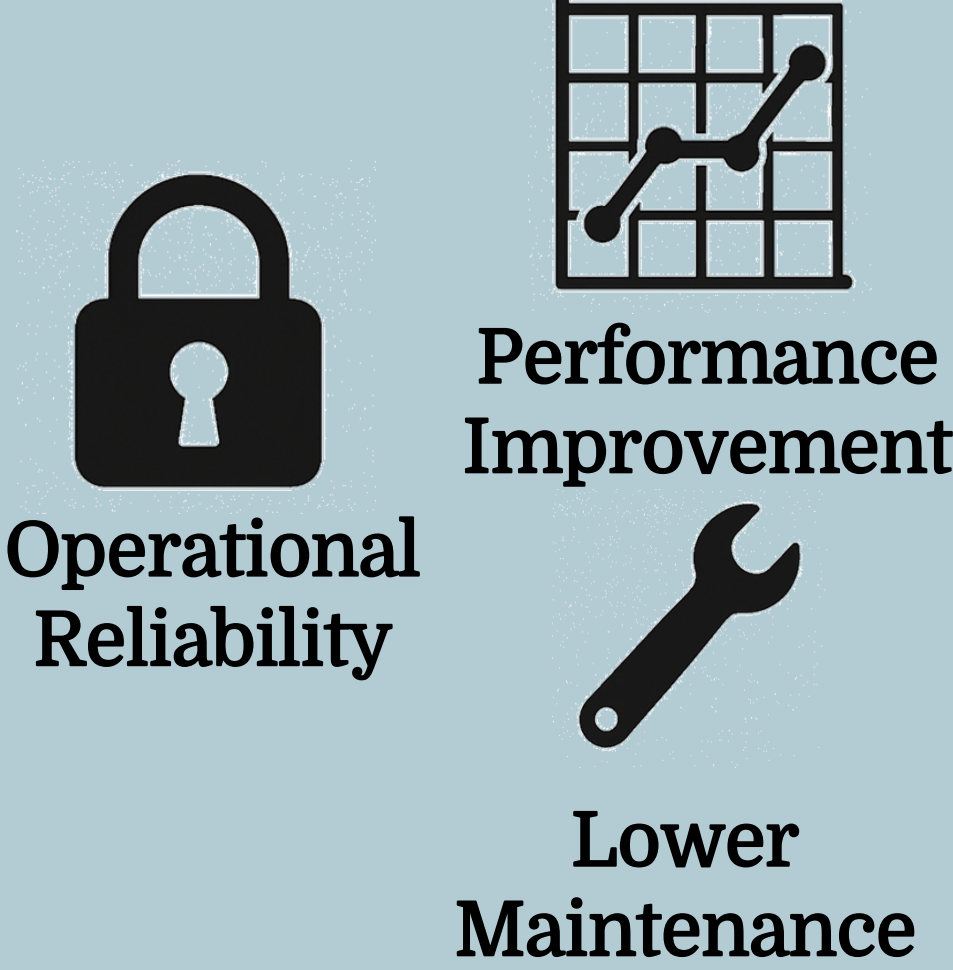


Fig1 . Mechanical gear schematic

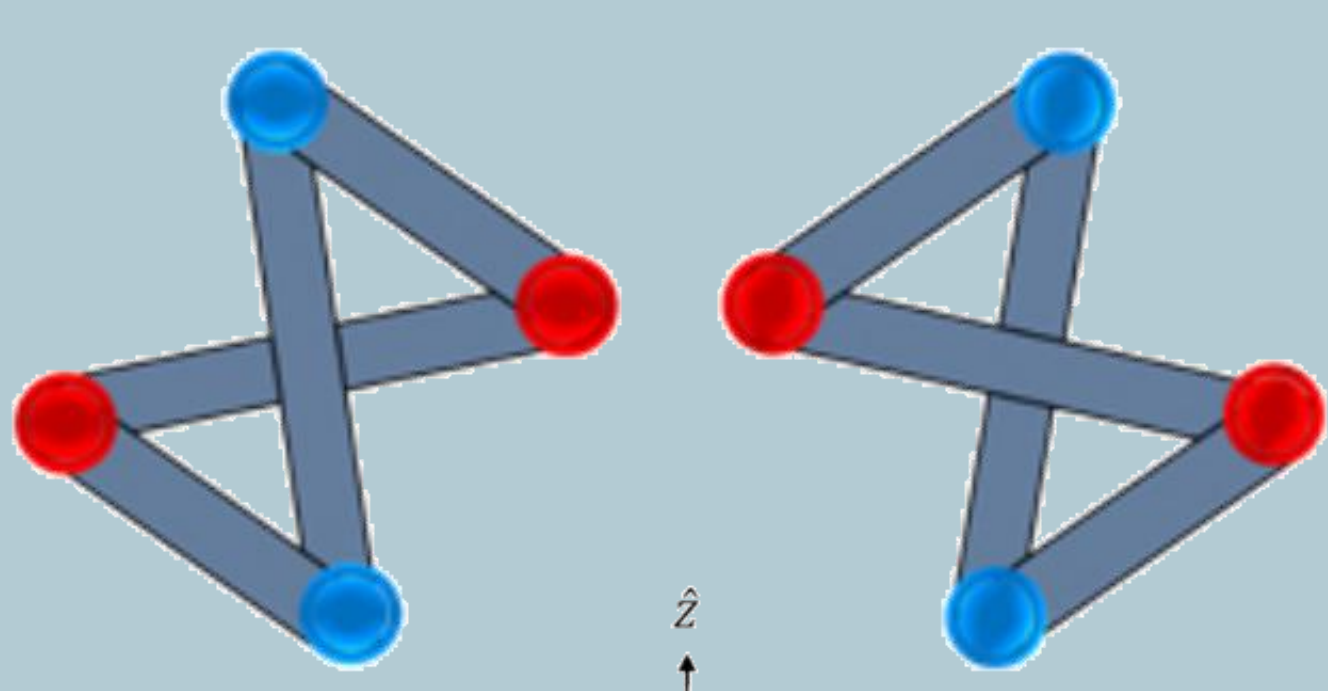
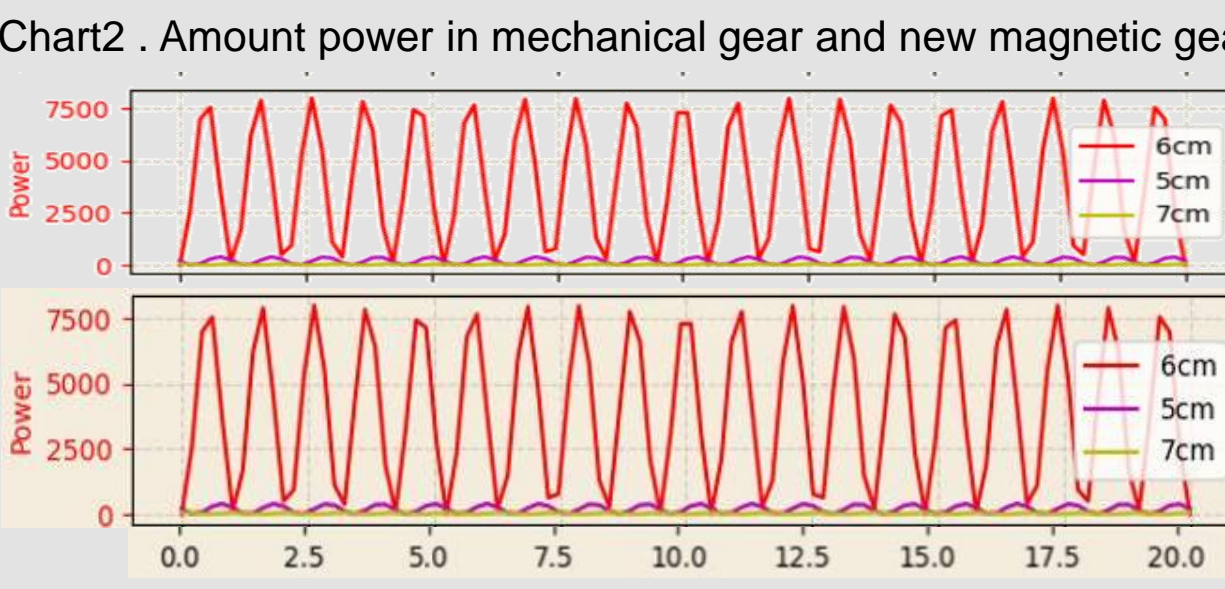
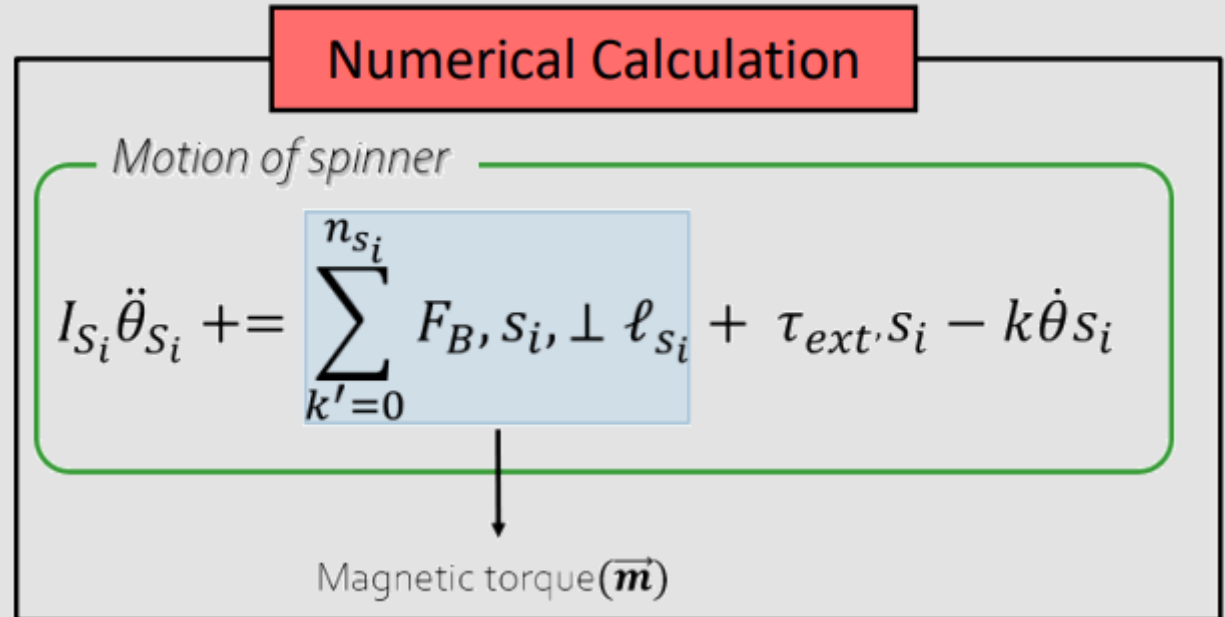
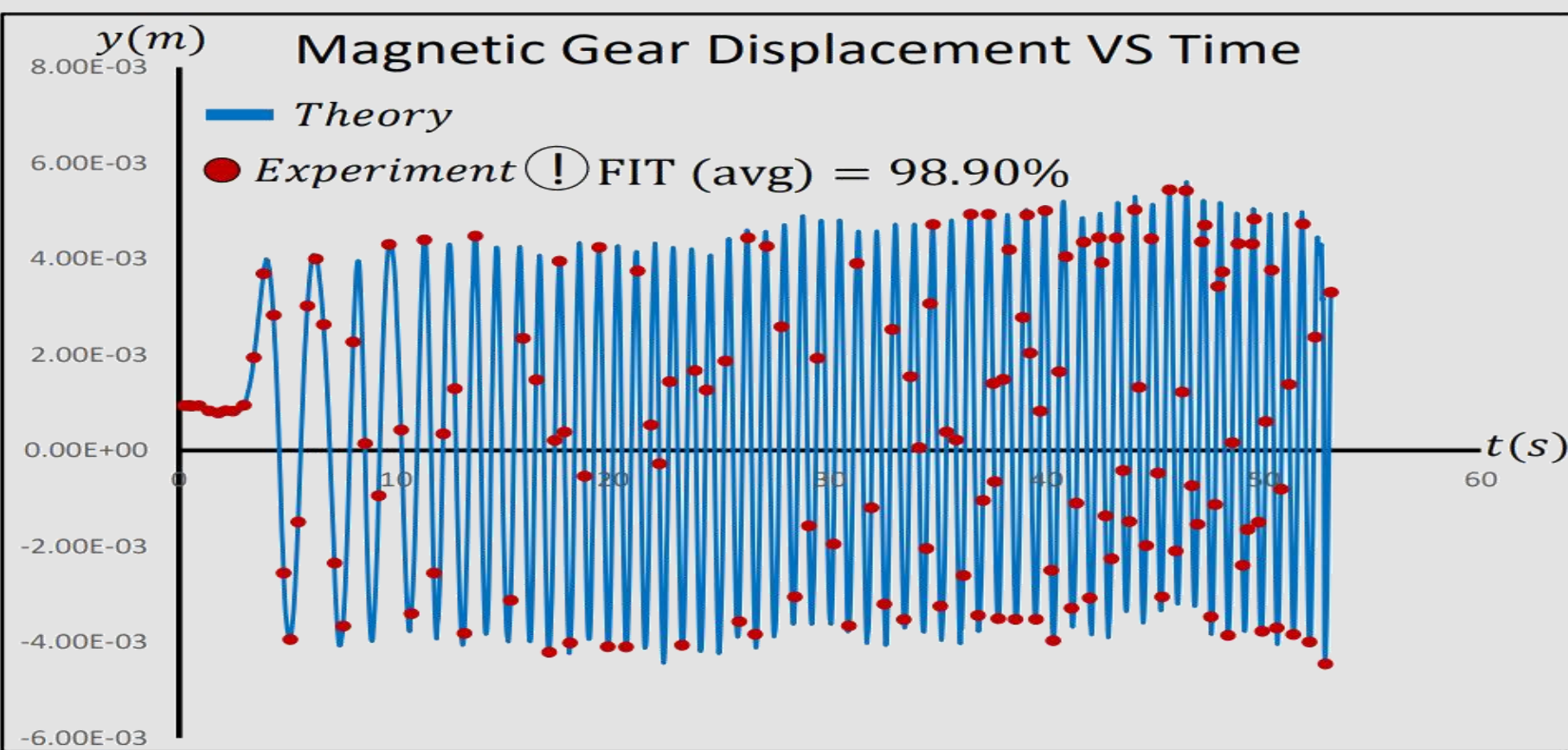


Fig2 . Magnetic gear schematic

Results

Experimental Verification

Chart1 . Calculating theory vs experiment in displacement



Performance Comparison

In comparison to the mechanical gear, the system proved greater efficiency, lower noise, longer durability, and enhanced overload strength on different industrial standards. Simulation setup assured more efficient torque transmission in conveyor and mixing systems.

Real Life Usage

Simulation setup assured more efficient torque transmission in conveyor and mixing systems.

Chart4 . Checking Vertical Gear efficiency in accuracy

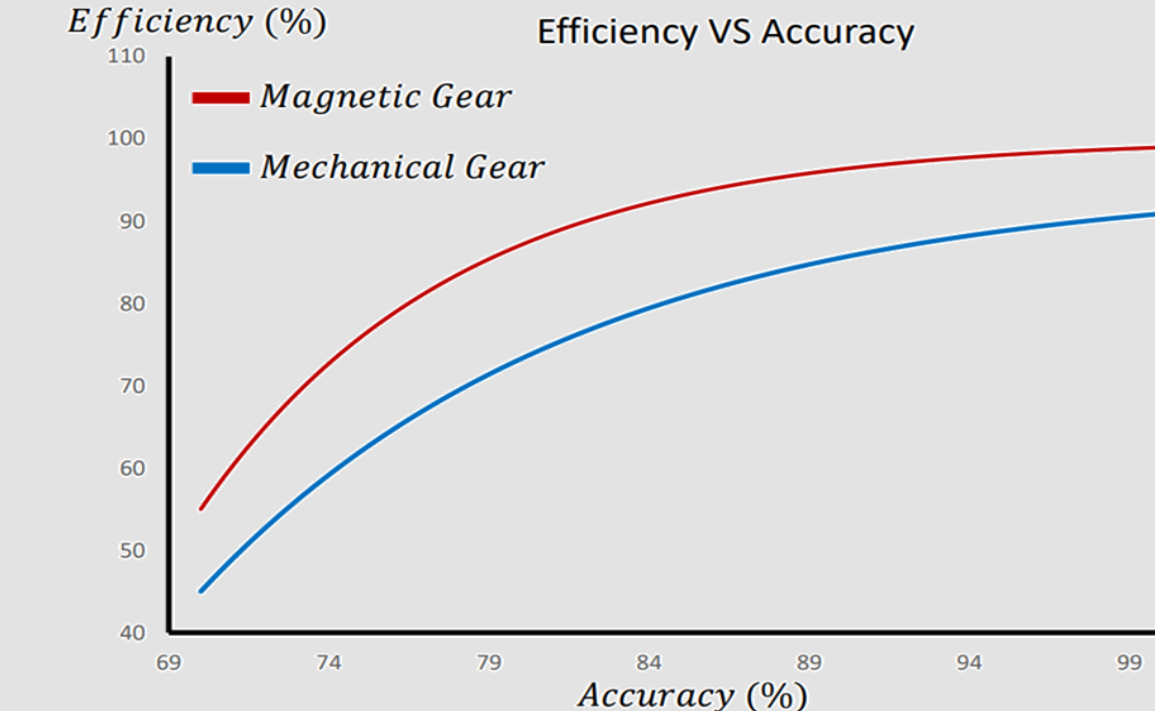
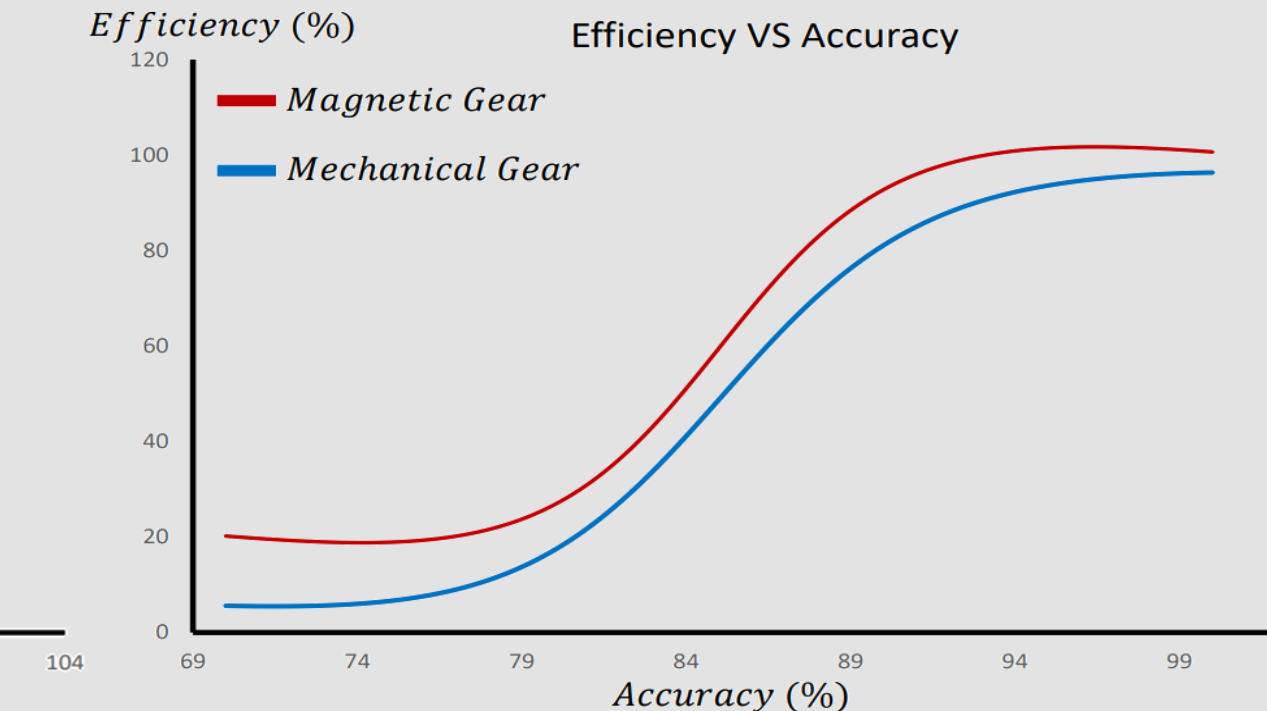


Chart5 . Checking Side by Side Gear efficiency in accuracy



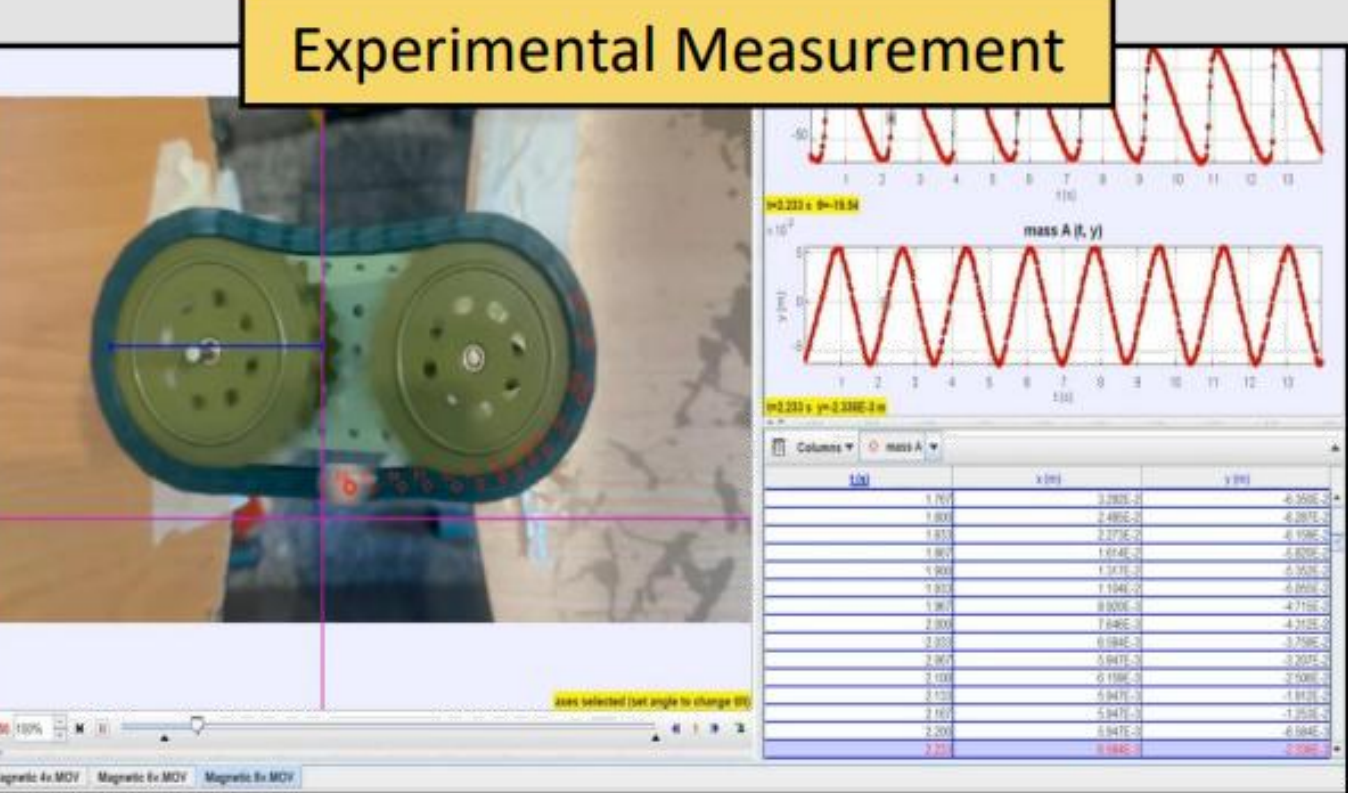
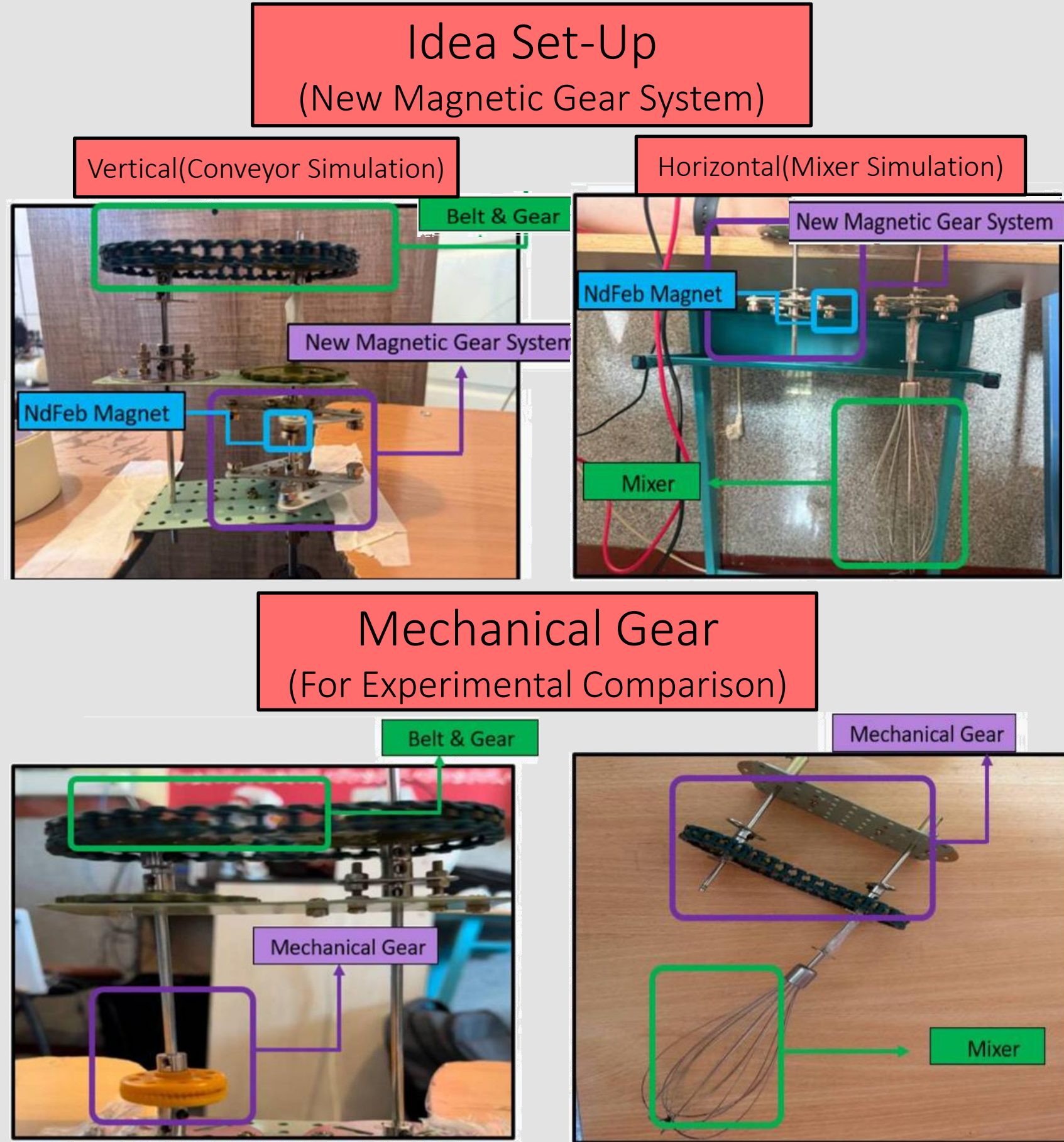
Discussion:

Three-phase testing ensured the industrial feasibility of the **New Magnetic Gear System** : test outcomes for practical verification ensured torque constancy, comparative experiments confirmed performance superiority, and field simulation demonstrated flexibilities. Combined, all outcomes vindicate its transition from concept to scalable industrial deployment.

Methodology

Gear Design:

The system includes two configurations. In the first, a four-blade magnetic gear is placed side-by-side with the driver, allowing smooth horizontal rotation. The second setup arranges the gear vertically above a magnetic driver, enabling contactless torque transfer through magnetic coupling.



Experimental Analysis began with idea verification testing, then comparative assessment, and field simulation to test performance, longevity, and industrial applicability.

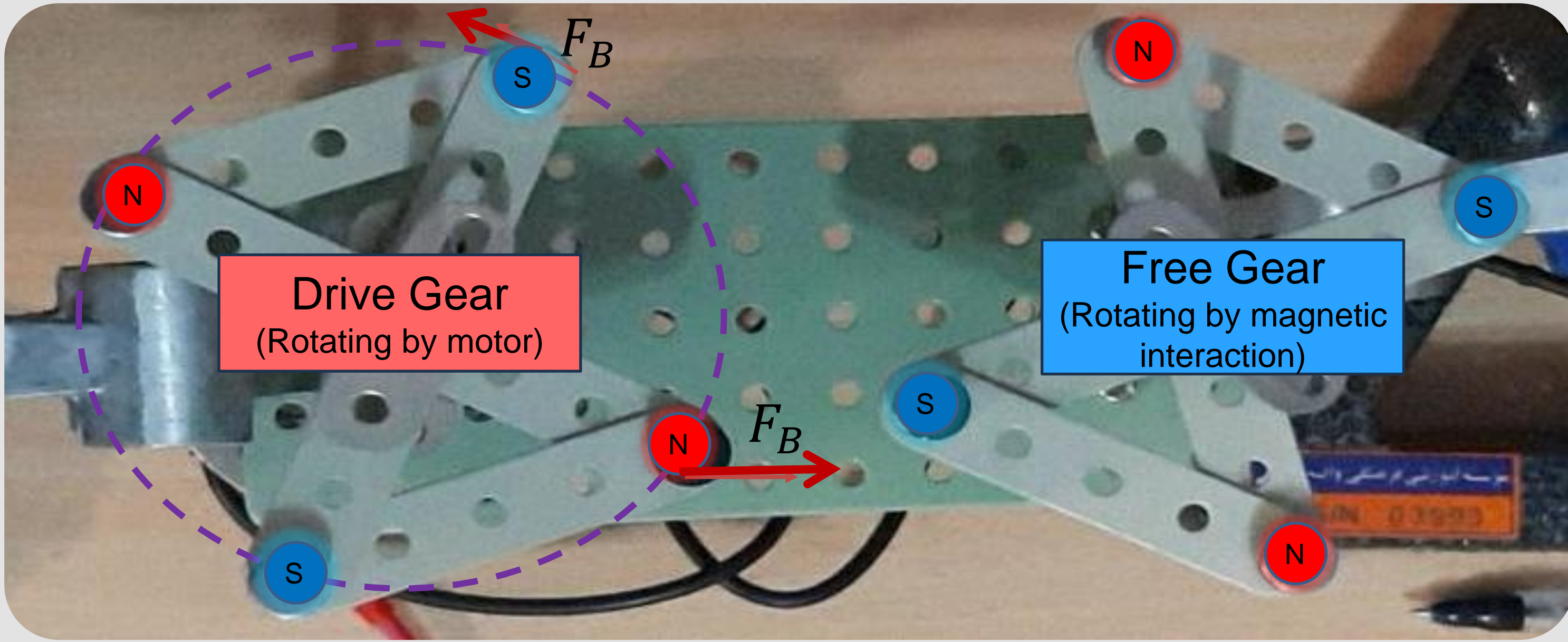


Fig3 . New Magnetic Gear System

Conclusion

Strategic analysis encourages industrial deployment with modular design, performance differentiation, and alignment with long-term innovation and sustainability goals.

Idea SWOT			
STRENGTHS	Weaknesses	Opportunities	Threats
1. Contactless Torque Transmission 2. Reduces Friction and Wear 3. Low Noise and Vibration 4. High Efficiency & Operational Accuracy 5. Longer Lifespan & Reduced Maintenance Costs	1. More Complex Design and Manufacturing 2. Higher Initial Cost due to Magnetic Materials 3. Limited Torque Capacity in High Load	1. Increasing Applicability in Efficient Systems 2. Growth Contamination-Sensitive Industries 3. Expansion of Affordable Energy Applications	1. Resistance to Replacing Mechanical Systems 2. Volatility Magnetic Material Prices Specialized 3. Specialized Training Needed for Operation

The system has been scored across an entire industrial grade scale—between 1 (poor), 2 (medium), 3 (good), 4 (very good) to 5 (efficiently)—based on precision, and efficiency in transmitting. It rated highest based on dependability and minimal maintenance testifying to its fit to be integrated into state-of-the-art manufacturing, robotics, and automation where performance and uptime are the most critical.

Table1 . Applications of New Magnetic Gear System in Different Industries									
Industries	Magnetic Gear	Mechanical Gear	Application of horizontal gear	Result	Industries	Magnetic Gear	Mechanical Gear	Application of vertical gear	Result
Paints & Coatings	5	3	Mixers for consistent blending without contamination	Easy cleaning, Low wear, Low vibration,	Medical Equipment	4	3	Precise, clean torque transmission ideal for sensitive medical devices.	Magnetic gear is better because of: Less wear, Low noise and Vibration
Battery Manufacturing	4	2	Idea for mixing electrolytes in sealed environments	Low maintenance, Precise Motion	Food & Beverage Industry	5	2	Hygienic operation without lubrication	Magnetic gear is better because of: Easy cleaning, Longer lifespan, less maintenance
Petrochemical Industry	3	4	Suitable for mixers handling volatile chemicals, minimizing ignition risks	Higher torque capacity, Easier to Source and Repair, Lower cost	Cleanroom Manufacturing	4	1	Reduces particle and contamination	Magnetic gear is better because of: No Lubricants, Low vibration, Longer lifespan
Textile chemicals	4	3	Applied in mixers to reduce wear and improve consistency	Low maintenance, Leak-Free Operation	Precision	3	4	Smooth, low-noise motion improves robotic precision.	Mechanical gear is better because of: Higher torque density, lower cost
Water Treatment System	4	2	Used in mixers for chemical dosing with reduce maintenance	Corrosion Resistance, Smooth Operation	Wind Turbines	3	1	Less wear and maintenance, extends lifespan	Magnetic gear is better of: Low maintenance, Low vibration, High efficiency



Advancing scalable, low-loss magnetic transmission to support clean energy and responsible production—enabling efficient, low-maintenance systems for sustainable industrial transformation in line with global development goals.

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References

