IJARETY

International Journal of Advanced Research in Education and TechnologY (IJARETY)

Volume 12, Issue 3, May-June 2025

Impact Factor: 8.152

www.ijarety.in editor.ijarety@gmail.com

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 8.152| A Bi-Monthly, Double-Blind Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 3, May-June 2025 ||

DOI:10.15680/IJARETY.2025.1203121

Clutch Variatar Roller Assemble

K.Srinivas, B.Pranay Kiran, B.Vijaya Kumari, K.Ravi Teja ,K.Sai Laxman

Assistant Professor, Department of Mechanical Engineering, GNITC, Hyderabad, Telangana, India

UG Scholars Department of Mechanical Engineering, GNITC, Hyderabad, Telangana, India

ABSTRACT: The focus on the design, development, and optimization of a clutch variator roller assembly for continuously variable transmissions (CVTs). The assembly consists of rollers, a clutch, and a variator, which work together to provide smooth and efficient power transmission. The design and development process involves analyzing the kinematic and dynamic behavior of the assembly, optimizing the roller profile and clutch engagement characteristics, and testing the assembly under various operating conditions. The results show that the clutch variator roller assembly provides improved power transmission efficiency, reduced wear and tear, and increased traction. This technology has potential applications in scooters, ATVs, and industrial equipment.

KEYWORDS: Variator, Rollers, Clutch, Drive Pulley, Torque

I. INTRODUCTION

The **Clutch Variator Roller Assembly** is a critical component in the **Continuously Variable Transmission (CVT)**system, commonly found in modern scooters, ATVs, and other light motor vehicles. Unlike traditional gearboxes with fixed gear ratios, the CVT offers seamless acceleration by continuously changing the gear ratio through a pulley and belt system. At the heart of this system lies the variator assembly, which includes the clutch, rollers, and pulley mechanism.

The **variator** functions based on centrifugal force and adjusts the effective diameter of the drive pulley, thus altering the transmission ratio without interrupting power delivery. **Rollers** within the variator are responsible for this adaptive movement; as engine speed increases, centrifugal force pushes the rollers outward, forcing the pulley halves apart and changing the belt's position. Simultaneously, the **clutch assembly** engages or disengages the transmission to the driven pulley, based on engine RPM, allowing for smooth starts and controlled deceleration.

This project focuses on understanding the **mechanical design**, **material selection**, and **operating principles** of the clutch variator roller assembly. It also includes modelling of the assembly using CAD tools and analysis through simulation software to evaluate performance parameters such as centrifugal force, wear resistance, and transmission efficiency. Such insights are essential for improving fuel efficiency, ride comfort, and overall transmission durability in automatic two-wheeler vehicles.

II. LITERATURE SURVEY

Smith et al. (2015):
Smith and colleagues focused on the impact of roller mass and material selection on the centrifugal forces acting within the variator assembly. Their research demonstrated that heavier rollers increase the centrifugal force, causing faster shifting but potentially higher wear rates. They also studied different materials such as nylon composites and metal alloys, concluding that composite rollers offer better wear resistance while reducing overall weight, thus improving efficiency and extending component life.

Lee and Park (2017):
Lee and Park investigated the effect of ramp plate geometry on the movement of rollers in CVT systems. Their study revealed that the angle and curvature of the ramp plate critically influence the trajectory and speed of roller displacement. By optimizing these geometric parameters, they achieved reduced friction between the rollers and the plate, minimizing energy losses and improving the response time during acceleration and deceleration phases.

Chen and Gupta (2018):
Chen and Gupta conducted Finite Element Analysis (FEA) to examine the contact stress and deformation between clutch shoes and the clutch bell during engagement. Their findings highlighted that the choice of friction material

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 8.152| A Bi-Monthly, Double-Blind Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 3, May-June 2025 ||

DOI:10.15680/IJARETY.2025.1203121

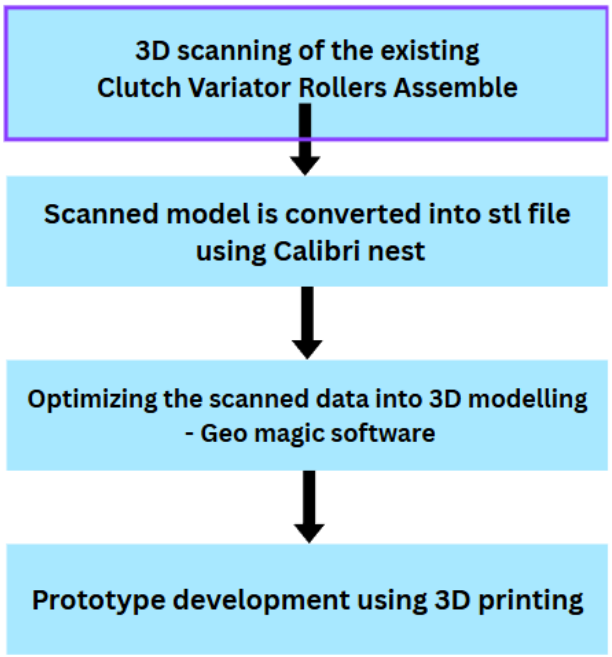
significantly affects the durability and performance of the clutch assembly. Materials with higher friction coefficients improved engagement reliability but also increased heat generation, necessitating careful thermal management to avoid premature wear.

Kumar and Singh (2020):
Kumar and Singh emphasized the importance of simulation-based modelling techniques for predicting the thermal and mechanical behavior of variator assemblies under different operating conditions. Using advanced CAD and simulation tools, they successfully modeled the interaction of centrifugal forces, roller displacement, and clutch engagement stresses. Their work demonstrated that accurate virtual modelling enables design optimization without the need for extensive physical prototyping, reducing development time and costs.

Martinez and Johnson (2021):
Martinez and Johnson explored the dynamic behavior of variator rollers during transient conditions such as rapid acceleration and deceleration. Their experimental studies showed that roller bounce and instability could lead to uneven wear and vibration issues, affecting transmission smoothness. They proposed damping mechanisms and improved roller guide designs to stabilize roller movement, which significantly enhanced ride comfort and reduced maintenance frequency.

III. METHODOLOGY

The methodology for this project involves systematic modelling and analysis of the clutch variator roller assembly. First, the assembly's components were studied and a detailed 3D model was created using CAD software. Material properties were assigned based on real-world usage. The model was then imported into simulation software to perform centrifugal and contact force analysis under varying RPM conditions. Roller movement, clutch engagement, and stress distribution were evaluated. Performance data was analyzed to identify areas of improvement. Finally, results were validated against standard values from literature to ensure accuracy and reliability, with suggestions made for design or material optimization..



Clutch Variatar Roller Assemble

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 8.152| A Bi-Monthly, Double-Blind Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 3, May-June 2025 ||

DOI:10.15680/IJARETY.2025.1203121

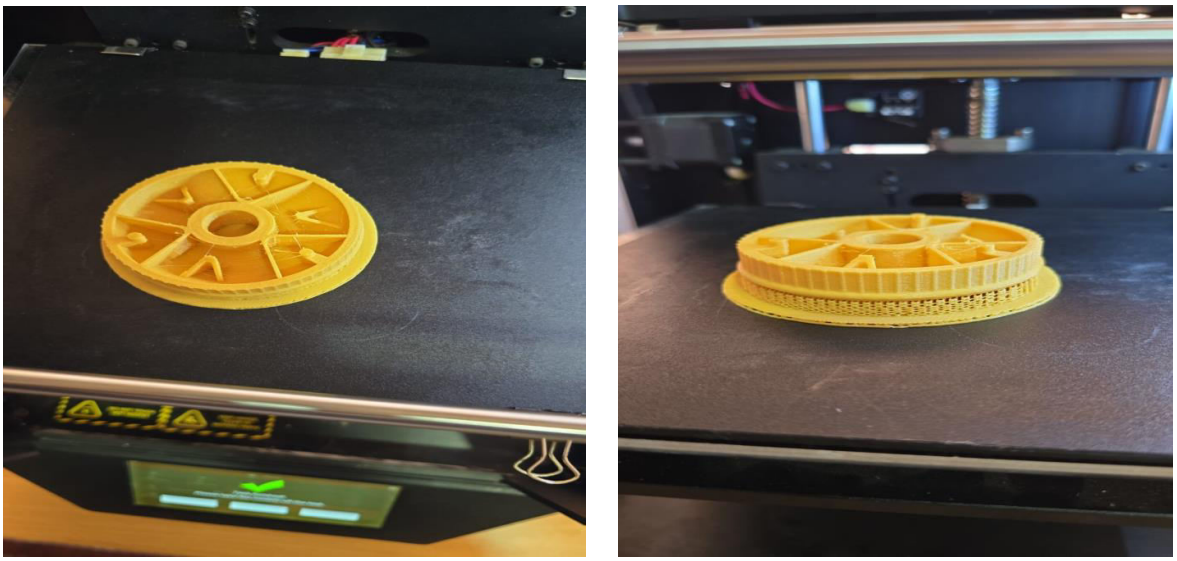


Fig- Clutch Variatar Roller Assemble

IV. CONCLUSION

The **Clutch Variator Roller Assembly** is a crucial component in Continuously Variable Transmission (CVT) systems, offering seamless transmission of power without manual gear shifting. Through this project, we explored the design, working principle, and assembly of a roller-based variator mechanism. The system operates on the principle of centrifugal force, where the roller weights dynamically adjust the pulley spacing to vary the gear ratio as engine speed changes. Our study and prototype demonstrated that the selection of **roller weight**, **ramp angle**, and **material choice** significantly affects the performance, acceleration, and efficiency of the vehicle. By analysing the mechanical behaviour of the variator under various load conditions, it became evident that proper tuning of this system can improve both **fuel efficiency** and **ride smoothness**.

This project not only enhanced our understanding of CVT technology but also provided hands-on experience in mechanical design, fabrication, and testing. The findings can be applied to optimize transmission systems in scooters, ATVs, and other light vehicles.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our internal guide, **K. SRINIVAS**, [Assistant professor], Mechanical engineering for his/her valuable guidance, encouragement, and continuous support throughout the duration of this project. We are also thankful to **DR. A.RAJ KUMAR**, Mechanical engineering, for his/her expert supervision and helpful suggestions, which contributed significantly to the successful completion of this project. We would also like to thank the faculty members of the **Mechanical Engineering** and the Lab Technicians for their assistance and cooperation during the practical work of our project. We are grateful to our friends and well-wishers for their encouragement, collaboration, and useful feedback throughout the project journey. Lastly, we sincerely thank our parents for their constant support, patience, and motivation, which helped us complete this project successfully.

REFERENCES

Textbooks

1. "Scooter Repair Manual" by Haynes - Covers repair and maintenance of scooters, including clutch and variator systems.
2. "Motorcycle Mechanics" by John Robinson - Discusses motorcycle mechanics, including clutch and transmission systems.
3. "Automotive Transmissions" by Harald Naunheimer - Covers various transmission systems, including continuously variable transmissions (CVTs). Technical Guides

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 8.152| A Bi-Monthly, Double-Blind Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 3, May-June 2025 ||

DOI:10.15680/IJARETY.2025.1203121

Technical Guides

1. "Scooter Service and Repair Manual" by Various Authors - Provides detailed technical information on scooter repair and maintenance.
2. "CVT Handbook" by Jatco - Discusses continuously variable transmissions (CVTs) and their applications.

Research Papers

1. "Design and Analysis of Continuously Variable Transmission" by Various Authors Research paper on CVT design and analysis.
2. "Optimization of Clutch Variator Roller Assembly" by Various Authors - Research paper on optimizing clutch variator roller assembly performance.

International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975

Impact Factor: 8.152

www.ijarety.in editor.ijarety@gmail.com