

# “Structural and Modal Analysis of Waste Segregator Machine”

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**Abstract**—This paper involves analysis of critical parts like conveyer structure, conveyer roller of waste segregator machine. Geometric models of these components are built up using SOLIDWORKS and finite modeling was carried out using ANSYS15.0. Structural analysis is carried out, from which we obtain the equivalent stress and total deformation of component. This forms basis to further modal analysis of components and we obtain frequencies and mode shapes of conveyer structure and roller.

**Keywords**—Conveyor structure, Conveyor roller, Modal analysis, Structural analysis.

## I. INTRODUCTION

Rapid population growth, urbanization and industrial growth have led to severe waste management problems in the cities of developing countries like India. The amount of waste generated demands a system of collecting and disposing the waste. Reutilization of waste and employment opportunities from waste management also have immense potential. However, it has been observed that the Municipal Corporations in India do not have sufficient resources or the technical proficiency necessary to overcome the problem. Effective waste management requires the participation of citizens, local governments, and private entrepreneurs.

To achieve our goal the waste separator machine must be stable and reliable enough to overcome vibration problems and can easily bear power transmitting actions. To be précised the staple components of machine must be strong to overcome all the failure issues. ANSYS is used to carry out structural and modal analysis of core components to study the behavior of components under actual load condition and to obtain its natural frequency with different mode shapes.

## II. PROBLEM DEFINITION

As the waste management system in India is not effective which leads to environment and health issues. As India is price based market so the main obstacle in designing is the product cost, its compactness, efficiency and also its reliability.

- Separating the different metals found in waste.
- Separating plastic from the waste.
- Recycling of waste
- Use of organic waste
- Disposal of harmful waste
- Separation of electronic waste

All the above mentioned problems are affecting the daily life of human being and results decrease in life. Therefore above mentioned problems should be eliminated by designing a mechanical system.

### 2.1 Analysis

3D solid model:-



Fig. 1 Waste Segregator Machine

3D solid model:-



Fig. 2 3D solid model of Roller Fig. 3 3D solid model of Conveyor structure

Meshing:-

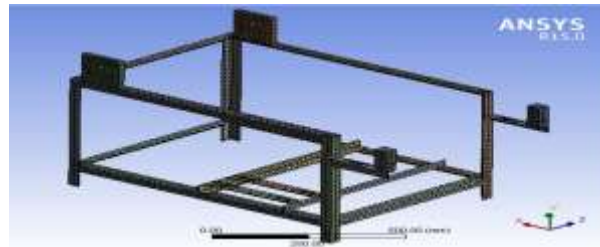
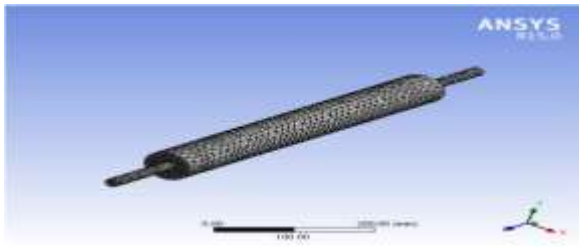


Fig. 4 Roller model after Meshing Fig. 5 Conveyor structure after Meshing

### III. CONSTRAINTS

Both ends of the roller are supported in the bearing. Other constraints are rotational velocity of roller, equivalent torque and the standard earth gravity.

### IV. ADVANTAGES

- It helps to separate plastics and metals from the waste.
- It helps to ensure the protection of the environment through effective wasteManagement measures.
- To protect the health of people by providing an affordableWaste sorting machine.
- Increase the number of Jobs within waste services.
- To save a lot of artificial sorting cost.
- To avoid hazardous conditions for inhabitants.

### V. LIMITATION

- Initial investment is high.

### VI. RESULT

The type of analysis are structural and modal (vibrational) analysis. We have considered four mode shape in the set of analysis. The result of structural analysis is used as input for the modal analysis. Modal analysis provides natural frequencies of the model and also the shape of the model at each frequencies.

Results of structural analysis: Conveyor structure and Roller

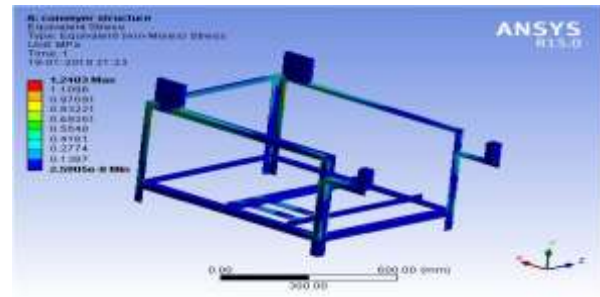
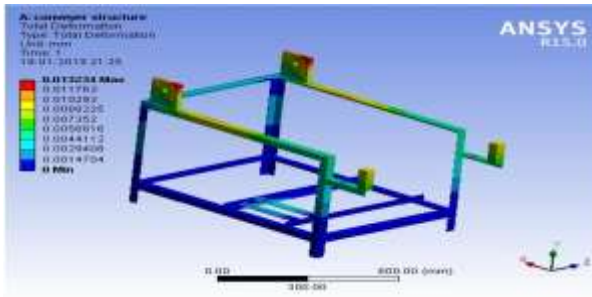


Fig. 6 Total deformation conveyor structure Fig. 7 Equivalent stress of conveyor structure

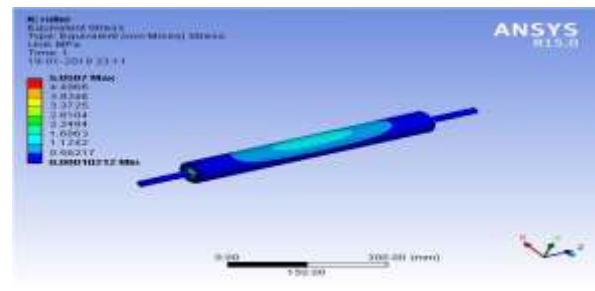
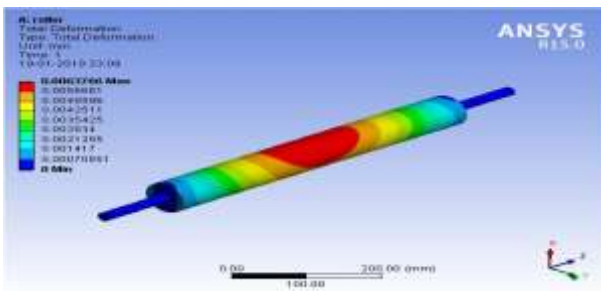


Fig. 8 Total deformation Roller Fig. 9 Equivalent stress Roller

Results of modal analysis: Conveyor structure and Roller

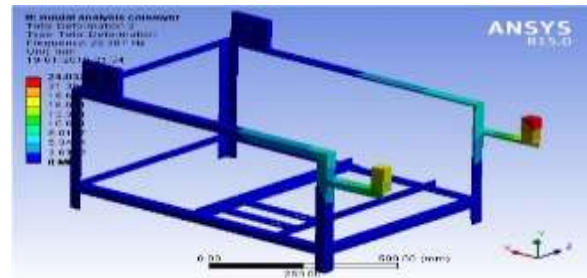
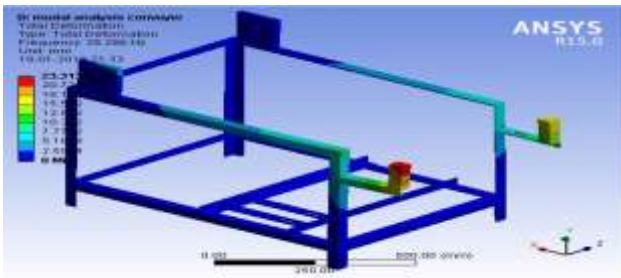


Fig. 10 1st order mode shape Fig. 11 2nd order mode shape

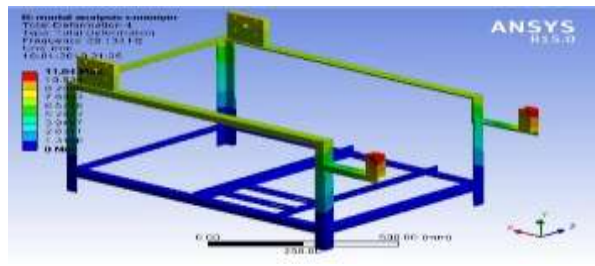
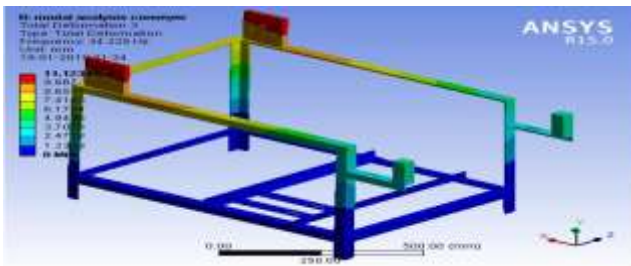


Fig. 12 3rd order mode shape Fig. 13 4th order mode shape

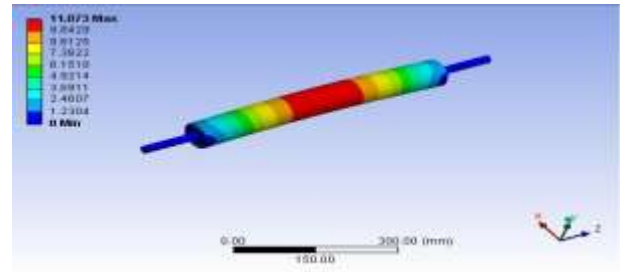
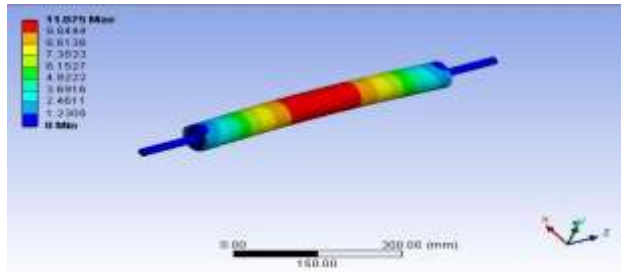


Fig. 161st order mode shape of roller Fig. 172nd order mode shape of roller

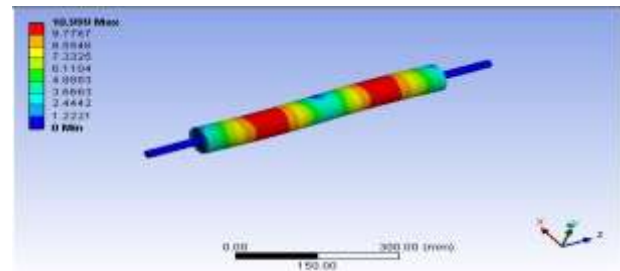
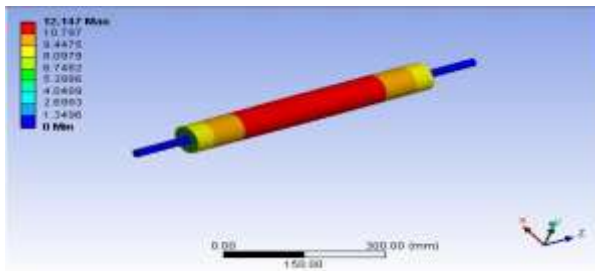


Fig. 183rd order mode shape of roller Fig. 194th order mode shape of roller

## VII. CONCLUSION

- The paper uses ANSYS for the structural and modal analysis of conveyor structure and roller of the waste segregator machine.
- Total deformation, equivalent stress analysis for analysis were conducted. We found that design can withstand the specific amount of load.
- The result satisfies the requirements of design. Hence after analyzing the conveyor structure and roller, we verified that design is within limit and it wouldn't fail in practical implementation.

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