An Approach to Design of Conveyor Belt using Natural Fibres Composite

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Abstract

Conveyor belt can be seen in the industries where material have to be conveyed for long distance; in such case it plays a vital role to full fill the requirement. As per the construction, the belt is main part of belt conveyor as it is the only part of the whole system that travels throughout the conveyor carrying the material above it. The construction of the belt mainly consists of the rubber with carcass material inside which provides the strength to the belt. This thesis presented the significance of the carcass material and analytical analysis performed to analyses the stress and deformation on the belt conveyor using various layering materials such as carcass, pineapple fiber and banana fiber. The CAD model is created using CAD software CATIA V5 and the finite element analysis performed on the belt using the software ANSYS 15.

Keywords: *Carbon nanotube (CNT) · Die-sinking electro discharge machine (EDM) · Grey relational analysis (GRA)*

1. INTRODUCTION

Conveyor belts are older method of conveying the material from one end to another in various industries and in construction sited for shifting the material across the world. Requirement of the best option is in demand for better result. Conventional material is now not that much effected for advanced material handling system. As per the advancement of technology various development are going in field of conveying system. In the belt conveyor belt is the main component as per the material handling concern and its only suffer from main load of the material and perform continuous operation. The belt is only responsible for carrying the heavy material and its strength is depend on the carcass material layer between the belt rubber material, hence there is need to study in the field of carcass material so that belt strength can be increase to certain level for better use economically.

The conveying system is a method to transport the material from one point to other point or can say that one location to other location. Its application can be seen in various industries such as automobile industries, power industries, aerospace industries, food processing industries, chemical industries, pharmaceutical industries etc. Many types of material are conveying using conveyor system such as coal, lime nuts, bottles, cartoons as per the utilization in industries. Many factors are responsible for selecting the conveyor for the operation which include the type, size of the conveyor, capacity of the conveyor etc. Conveyors are the best option in industries to reduce the operating cost and increase the production by eliminating the manual power for the same [2].

2. RELATED WORK

S.Rajeshkumar [1] performed the design and analysis of the belt conveyor for finishing house pulper. The main motive of the research is to overcome the human effort and also to reduce the labour cost. **Gaikwad [2]** explained the difficulties faced by manual operation and feeding in various industries such that it is taken as well as not safe as per the human safety concern, hence the author suggested to use the belt conveyor for feeding purpose in order to reduce the human effort and to increase the speed of feeding in the system. **Salave V. (2017)** The present research represents the design of 360 degree belt conveyor with its all components for material handling in the industry and concluded that various advantages and application: **Mr. Memane Vijay S [4]** optimizing the weight of the belt conveyor by optimizing the design of the main basic parts of the belt convey using the ANSYS 14.0 software which include the channels, supporting rollers etc. In the complete research Modal and transient analysis was performed on the optimized design and the result concluded that the

design was safe as it showed the FOS greater than that of the existing, hence provided the opportunity to further optimization of the weight of the conveyor belt

Belt conveyor system is the most popular system for material handling in various industries as it requires low maintenance and can be used for long distance conveying too. Various developments are going on to increase the strength of the belt and the strength of the belt is mainly depend on the carcass material between the top and bottom layer of the belt. It has been observed that change in carcass material characteristics can lead to better result for better strength and low deformation rate such that it can withstand in high working load condition also.

3. METHODOLOGY

This paper presented the significance of the carcass material and analytical analysis performed to analyses the stress and deformation on the belt conveyor using various layering materials such as carcass, pineapple fiber and banana fiber as shown in figure 1. The CAD model is created using CAD software CATIA V5 and the finite element analysis performed on the belt using the software ANSYS 15 in order to achieve following objective.

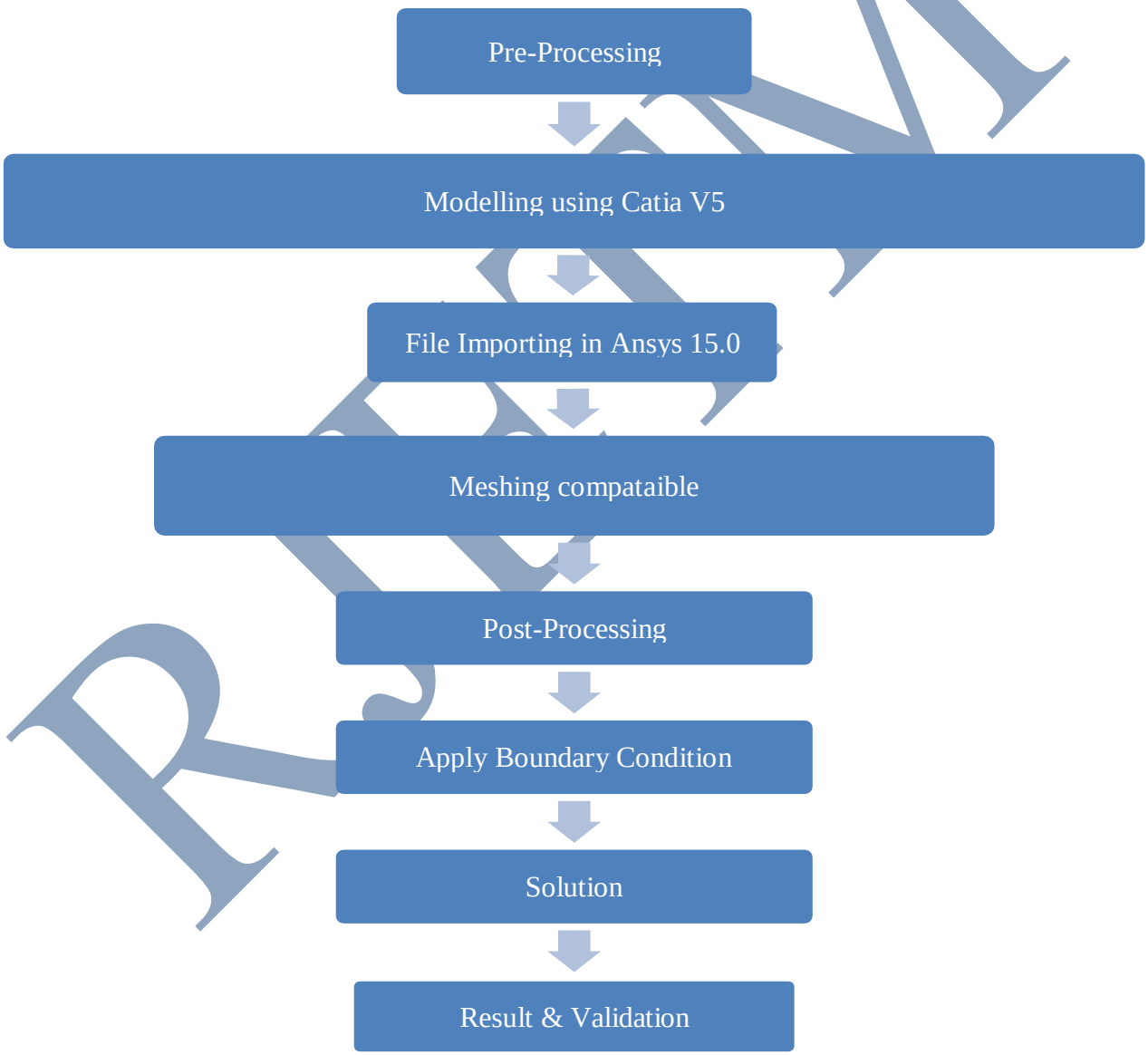

Figure.1. Setup of working

- To study and comparison of different type carcass material are used in conveyor belt, replacing conventional material.
- To perform the structural analysis using analysis software package ANSYS 15.
- To improve the workability of the conveyor with introducing the better material for layering the conveyor belt.
- To ensure the safety as to reduce the probability of damaging Enhance the life cycle of conveyor belt by improving material quality.

4. RESULT ANALYSIS

The analysis results are found in different material used in this study. The deformation of canvas material is 26.677mm and stress is 10.312 MPa but when apply carcass material layer in centre of belt the deformation is found 11.164mm and stress is 30.777 MPa. Further the study carcass material is replaced in banana fiber and pineapple fiber, the deformation in banana fiber carcass material belt is 9.7297 mm and stress is 34.415 MPa, and deformation of pineapple fiber carcass material belt is 8.2237 mm and deformation is 66.073 MPa.

Table 1 Deformation and stress of conveyor belt

Number of case	Total Deformation (mm)	Equivalent stress (MPa)
Case-1	26.677	**10.312**
Case-2	11.164	**30.777**
Case-3	9.7297	**34.415**
Case-4	**8.2237**	**66.073**

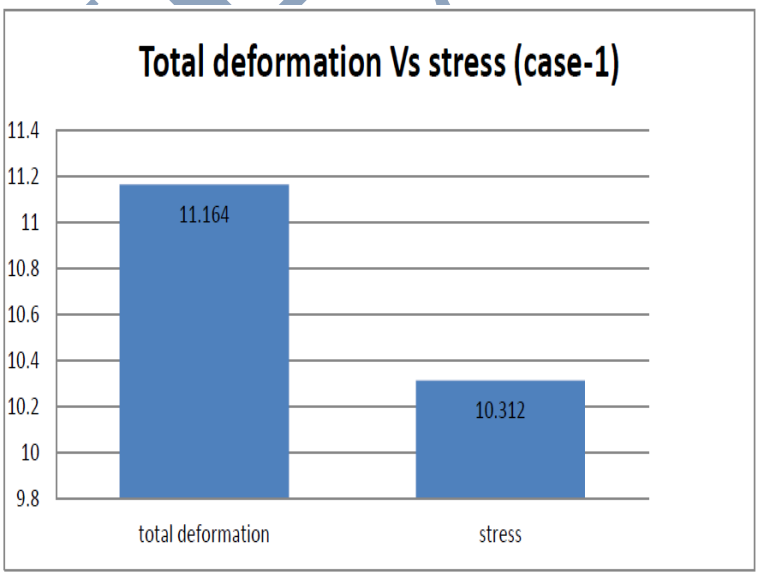

Figure: 2 Comparison of total deformation and stress for case-1

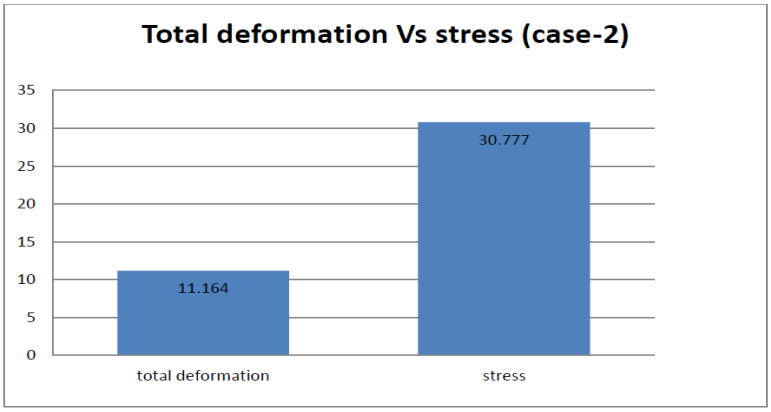

Figure: 3 Comparison of total deformation and stress for case-2

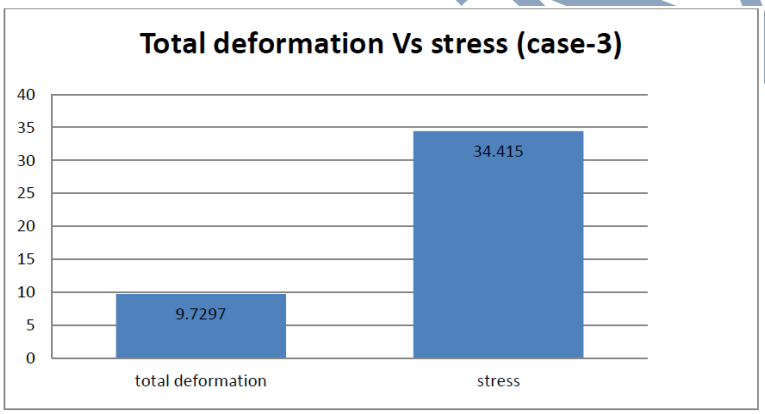

Figure: 4 Comparison of total deformation and stress for case-3

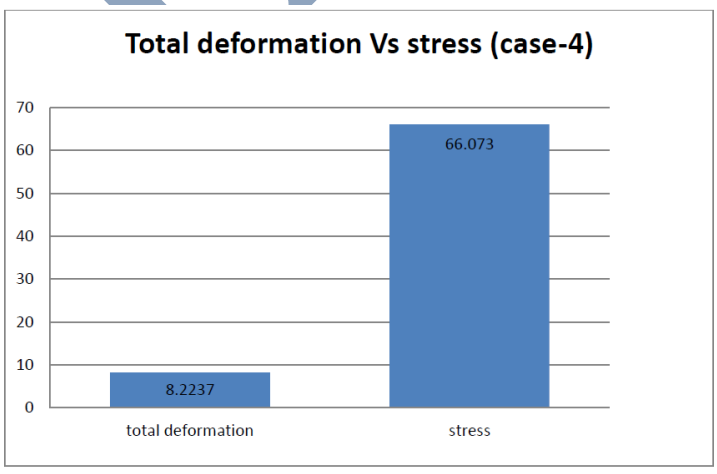

Figure: 5 Comparison of total deformation and stress for case-4

5. CONCLUSION

During the design process of belt conveyors or the similar structures, the main concern is not only to keep the system safe in terms of strength. The design must fulfill the minimum safety conditions as well as it should be light in weight and cheap. Therefore, to be able to reach the optimum design, system should be modified and revised numerous times. The result shows that the presence of carcass material in conveyor belt is very effective; the deformation of carcass material belt conveyor is less compared to simple conveyor belt. There are four cases shown in which the first is simple belt conveyor, second is simple carcass material, third is banana fiber carcass material and fourth is pineapple fiber material. The minimum deformations are found in pineapple fiber and banana fiber and given materials' maximum stress is under yield limit hence the new proposed material is safe for manufacturing. Calculating the system with analytical approaches leads to long time in calculation and values so obtained are often. In belt conveyor, the design process and related studies which require repetitive calculations. The designers can save time by using finite element method. Constructor can change the model in computer environment and get the results of the new design via finite element method without wasting time. Also, this is the most practical and reliable way to reach the optimum design in terms of deformation, stress, and availability of material.

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