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# STUDY AND ANALYSIS OF ROLLER CONVEYOR IN MATERIAL HANDLING

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## ABSTRACT

In industries, it is very necessary to move the components from one area to the other in a regular basis making it desirable to minimize the workers involved in it. In this work we have designed a conveyor which can be used in industries. It is very necessary to send material from one place to another in an industry in a convenient manner and hence a need to find a way to transmit the materials and hence in this work we have made a conveyor model which is used for the material transformation from one end to another.

The main objective of this study is to explore the analysis of a roller. This has entailed performing a detailed static analysis. The study deals with static analysis. A proper Finite Element Model is developed using Cad software Pro/E Wildfire 4.0.

**KEYWORDS**: Conveyor, Roller,Stress, Strain,Deformation.

## INTRODUCTION

Conveyors are essential to productivity, from light-duty package-handling roller conveyors in distribution centers to overhead and towline chain conveyors carrying automobiles through assembly to massive ore-handling belt conveyors. To avert production stoppages due to conveyor failure, progressive companies use predictive condition monitoring technologies to monitor those assets. The objective is to detect impending failures before they occur, and take corrective action during scheduled production shutdowns. One of those technologies is thermograph, or IR Imaging. Thermal imagers capture two dimensional images representing the apparent surface temperatures of conveyor components, and are excellent tools for monitoring conveyors.

- Conveyors are able to safely transport materials from one level to another, which when done by human labor would be strenuous and expensive.
- They can be installed almost anywhere, and are much safer than using a forklift or other machine to move materials.
- They can move loads of all shapes, sizes and weights. Also, many have advanced safety features that help prevent accidents.

There are a variety of options available for running conveying systems [3], including the hydraulic, mechanical and fully automated systems, which are equipped to fit individual needs. Conveyor systems are commonly used in many industries, including the automotive, agricultural, computer, electronic, food processing, aerospace, pharmaceutical, chemical, bottling and canning, print finishing and packaging. Although a wide variety of materials can be conveyed, some of the most common include food items such as beans and nuts, bottles and cans, automotive components, scrap metal, pills and powders, wood and furniture and grain and animal feed [3]. Many factors are important in the accurate selection of a conveyor system. It is important to know how the conveyor system will be used beforehand. Some individual areas that are helpful to consider are the required conveyor operations, such as transportation, accumulation and sorting, the material sizes, weights and shapes and where the loading and pickup points need to be [6]

**Types of Conveyor Systems**

- Gravity Conveyor systems
- Powered Belt Conveyor systems
- Pneumatic conveyor systems
- Vibrating conveyor systems
- Flexible conveyor systems

- Vertical conveyor systems and spiral conveyors
- Live Roller Conveyor systems

## OVERLAND CONVEYOR DESIGN

**The design of the conveyor includes the following procedures**

• Static and dynamic analysis
• Complete design specifications
• Control theory
• Feasibility studies and cost estimation
• Terrain modeling with earthwork optimizations
• Rubber viscoelasticity for accurate power predictions
• Commercial software for conveyor design

## CONVEYOR PARTS

A conveyor belt (or belt conveyor) consists of two or more pulleys, with a continuous loop of material - the conveyor belt - that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport industrial and agricultural materials, such as grain, coal, ores, etc. generally in outdoor locations. Generally companies providing general material handling type belt conveyors do not provide the conveyors for bulk material handling. In addition there are a number of commercial applications of belt conveyors such as those in grocery stores.

The belt consists of one or more layers of material they can be made out of rubber. Many belts in general material handling have two layers. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover. The carcass is often a cotton or plastic web or mesh. The cover is often various rubber or plastic compounds specified by use of the belt. Covers can be made from more exotic materials for unusual applications such as silicone for heat or gum rubber when traction is essential.

Material flowing over the belt may be weighed in transit using a beltweigher. Belts with regularly spaced partitions, known as *elevator belts*, are used for transporting loose materials up steep inclines. Belt Conveyors are used in self-unloading bulk freighters and in live bottom trucks. Conveyor technology is also used in conveyor transport such as moving sidewalks or escalators, as well as on many manufacturing assembly lines. Stores often have conveyor belts at the check-out counter to move shopping items. Ski areas also use conveyor belts to transport skiers up the hill.

A wide variety of related conveying machines are available, different as regards principle of operation, means and direction of conveyance, including screw conveyors, vibrating conveyors, pneumatic conveyors, the moving floor system, which uses reciprocating slats to move cargo, and roller conveyor system, which uses a series of powered rollers to convey boxes or pallets.

## THE STRUCTURE AND LOADING OF THE CONVEYOR BELTS

There are often used conveyors with the belt with textile carcass to transport the material in mining industry. Such a belt consists of the following components The carcass provides the necessary strength and impact resistance for the conveyor belt, and it is also used to force transmission. It could be defined as a multi-element part of the conveyor belt connected with elastic material, which ensures the connection of the single components with one another and the dispersal of the energy at conveyor belt in operation. The top cover and protective edge enwind the carcass and protect it against the mechanical damage caused by transported material, against humidity impact and also against chemical and thermal influence affecting the conveyor belt. The bottom cover interacts with the rollers and with the drums of the conveyor and defends the carcass against their negative impact. Conveyor belt with the textile carcass The carcass provides the necessary strength and impact resistance for the conveyor belt, and it is also used to force transmission. It could be defined as a multi-element part of the conveyor belt connected with elastic material, which ensures the connection of the single components with one another and the dispersal of the energy at conveyor belt in operation. The top cover and protective edge enwind the carcass and protect it against the mechanical damage caused by transported material, against humidity impact and also against chemical and thermal influence affecting the conveyor belt. The bottom cover interacts with the rollers and with the drums of the conveyor and defends the

carcass against their negative impact. The wearing of the conveyor belts depends on different factors, but mainly on operating conditions of the belt and on the type of transported material. The conveyors are continuous transport systems, which are able to transfer significant quantum of material. The downtime required for the repair or exchange of the broken belt always means huge economic costs. The wearing could have many causes. The belt is under wearing mostly at the input place where the conveyer is loaded. According to the experience from the operation of a belt, it is stated that up to 80 % of all damages of a conveyor belt are at the loading place of conveyor – at the input place.

The impact force, which is one of the basic reasons of conveyor belt wearing, rises at the input places. This point load is the consequence of the impact of the sharp-edged pieces of the transported material on the belt. If the impact energy is greater than the capability of the consoles, and of the conveyor belt to absorb this energy, then the conveyor belt damage occurs; first of all, the top cover in the form of transverse and longitudinal scratches, punctures and perforations. The impact resistance is related with the wearing, eventually with the damage of conveyor belts on the input places. This property is one of the most important properties, but it is not classified yet.

## WORK DONE

S. M. Shinde and R.B. Patil (2012) described about Optimization Technique Used for the Roller Conveyor System for Weight Reduction. This Paper involves geometrical and finite element modeling of existing design and optimized design. Geometrical modeling was done using Catia V5R19 and finite modeling was done. Results of Linear static, Modal and Transient analysis of existing design and optimized design are compared to prove design is safe. Optimization gives optimum design for same loading condition with huge amount of weight reduction. Using this procedure and using practical available structure 30.931% weight reduction is achieved.

University of New South Wales Mechanical and manufacturing engineering research about Redesign of an Underground Conveyor Using Composite Materials. In this paper the design using composite material is required for a conveyor operating underground. Various designs incorporating fiberglass with vinyl ester resin were submitted for approval in the relevant legislations and standards. These designs were analyzed using ANSYS (analysis software) to recommend the lightest and cheapest design.

## PROBLEM DEFINITION

In this work, an attempt is made to test the feasibility of a fiber composite material with optimum properties with an idea towards replacing the existing stainless steel material in industrial conveyor application.

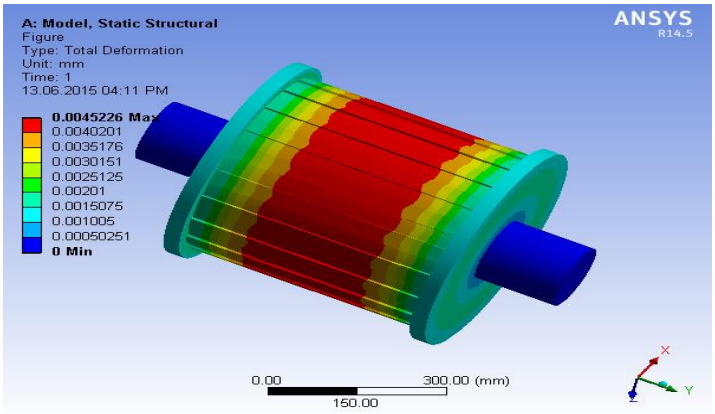
## OBJECTIVES OF THE WORK

In this work we are intending to study the conventional roller by designing a 3D model of the axle by using pro-e software and will try to analyze it for material of the roller using ansys software.Specifically we are analyzing the rotational velocity and moment acting on the roller where the the bearings are made by stainless steel the material.

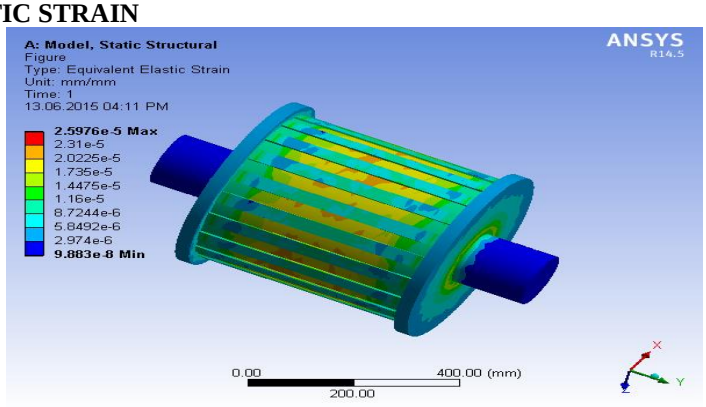
## RESULTS AND DISCUSSION

**RESULTS FOR STAINLESS STEEL MATERIAL**

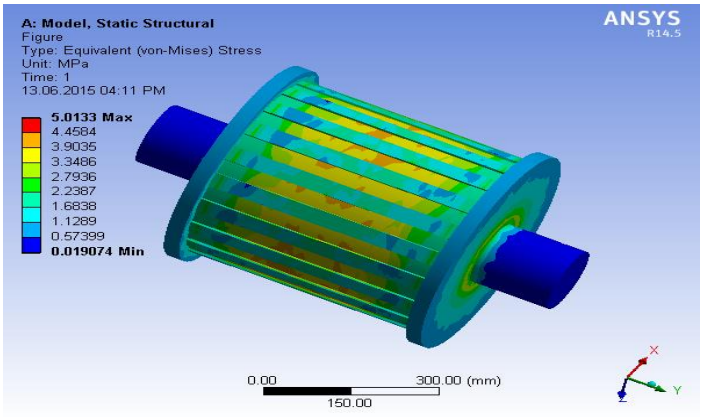
**TOTAL DEFORMATION**



**EQUIVALENT ELASTIC STRAIN**




**EQUIVALENT STRESS**




## RESULT FOR EXISTING MATERIAL

**STAINLESS STEEL**

| | MINIMUM | MAXIMUM |
|---|---|---|
| **Total deformation (mm)** | 0 | 4.522e-3 |
| **Equivalent elastic strain (mm/mm)** | 9.883e-8 | 2.597e-5 |
| **Equivalent stress MPa** | 1.907e-2 | 5.013 |

***Table 1 Measurement of different parameters of the***

## CONCLUSION

Analysis has been carried out by stainless steel (conventional material). The results such as total deformation, equivalent elastic strain and equivalent stress has been determined. The table 1 above gives the details of the analysis performed. .In the further work we intend to carry on the same analysis for the composite material and will try to come at conclusion regarding the feasibility of composite materials to be used in rollers.

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