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Review Paper on Low Cost Conveyor Design Reduction of Weight of Conveyor System

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Abstract: The aim of this project is to redesign existing roller conveyor system by designing the main part Roller to minimize the overall weight of the assembly and to save considerable amount of material.
Keywords: young modulus (e), poissons ratio, shear modulus(g), density

I. INTRODUCTION

Conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are very useful in many applications such as transportation of heavy and bulky materials. Conveyor systems facilitate fast and effective transportation for variety of materials, that's why they are popular in packaging Industries. There are floor and overhead conveyors available in market. These type of conveyor consists of power & free, enclosed tracks, I-Beam, and towline. these systems are used in various industries because of benefits they provide.

II. PROPOSED FLOW OF WORK AND METHODOLOGY

A. Flow of Work

1) To generate a surface model suitable for linear static Analysis.
2) To generate a finite element model of the same.
3) To conduct all the necessary tests on prototype.
4) To conduct the linear analysis to verify the behavior.
5) To confirm the prototype for the particular (permissible load).

B. Methodology

1) 3D modeling of roller as per dimension
2) Analysis of roller in ANSYS for static loading condition
3) For weight optimization we use Glass Fiber (GF) material for roller
4) Design of roller for GF material by using hand calculation.
5) 3D model of roller as per result of hand calculation.
6) Analysis of roller in ANSYS for static loading condition.
7) Check for result if result are not Ok then again design in ANSYS and then go for manufacturing..
8) After manufacturing take result by using UTM for deflection in roller.

III. PROBLEM DEFINITION

The aim of this project is to redesign existing roller conveyor system by designing the main part Roller to minimize the overall weight of the assembly and to save considerable amount of material.

A. Objectives

The following are the objectives of the study

1) Study of existing roller conveyor system and design
2) Geometric modeling of existing roller conveyor design
3) to generate FEA and parametric model using ANSYS Parametric Design Language (APDL) program.
4) To conduct linear static analysis of existing roller conveyor model.
5) Modification of main conveyor parts for optimization

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6) To conduct Analysis of Modified design for same condition.
7) Recommendation of new solution for optimization of existing design.

IV. MATERIAL SELECTION

A. Properties of Roller Material

1) Actual MS Roller

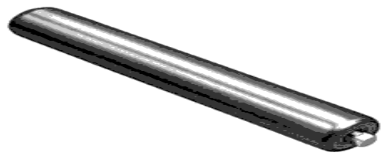

Fig. 1.Actual MS Roller:

TABLE.1

Sr. no	Properties		MS
1	YOUNG MODULUS(E)	EX(MPa)	200000
2	POISSONS RATIO	PRXY	0.26
3	SHEAR MODULUS(G)	GX (MPa)	79300
4	DENSITY	ρ (kg/mm³)	0.000007850

Table1:Properties of Mild Steel Roller

2) Composite Material Roller

Fig. 2.Composite Material Roller:

TABLE.2

Sr. no	Properties		E-glass/epoxy	Carbon epoxy
1	YOUNG MODULUS(E)	EX(MPa)	43000	177000
2		EY(MPa)	6500	10600
3		EZ(MPa)	6500	10600
4	POISSONS RATIO	PRXY	0.27	0.27
5		PRYZ	0.06	0.02
6		PRZX	0.06	0.02
7	SHEAR MODULUS(G)	GX (MPa)	4500	7600
8		GY(MPa)	2500	2500
9		GZ(MPa)	2500	2500
10	DENSITY	ρ (kg/mm³)	0.000002	0.0000016

Table2: Properties of Roller

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V. MODELING TOOLS

A. CATIA V5R21

Commonly used to generate a 3D Product Life cycle , CATIA supports different stages of product development, conceptualization, drafting, manufacturing (CAM), and engineering (CAE). CATIA promotes collaborative engineering in every disciplines and it also facilitate surfacing & shape design in mechanical engineering, and equipment and systems engineering.

CATIA provides a body for surfacing, and gives visual solutions in reverse engineering and also facilitate modify, and validate complex innovative shapes, from subdivision, styling, and Class A surfaces to mechanical functional surfaces.

CATIA facilitates the creation of 3D parts, from 2D sketches, composites models, sheet metal, forged and tooling parts up to the definition of mechanical assemblies.

CATIA facilitates the design of electronic, electrical, and distributed systems such as fluid and HVAC systems, all the way to the production of documentation for manufacturing.

1) Systems Engineering CATIA offers a body to solve complex model and many products by systems engineering approach. It covers basic definition, architecture, behavior modeling and the virtual product and embedded software generation. Although later versions of CATIA V4 implemented NURBS, CATIA V4 uses a non-manifold solid engine. CATIA V5 features a parametric solid/surface-based package that uses NURBS as the core surface representation and has several workbenches that provide KBE support. V5 can work with other applications, including Enova, Smart am, and various CAE Analysis applications.
2) *Modeling of Mils Steel Roller:*

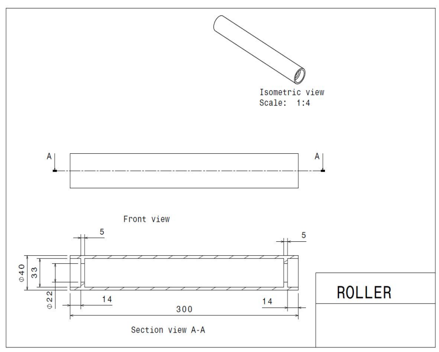

Fig 3: Drawing of MS Roller

3) *Modeling of Glass Fiber Roller*

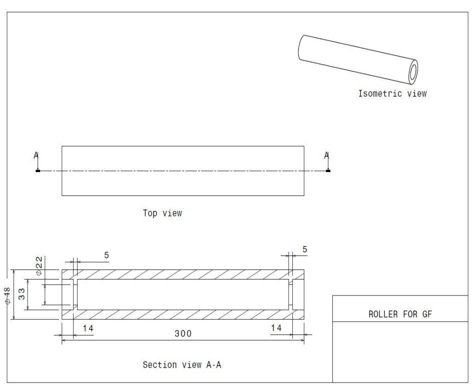

Fig. 3.Glass Fiber Roller

B. ANSYS 14.5

ANSYS Work bench can be used as a software platform or framework where we perform our analysis (FE- Analysis). In other words, workbench allows us to organize all our related analysis model and databases under same frame work. Among other things, this means that we can use the same material property set for all our analysis. Some of the applications can fit into the workbench framework are:

1) Design model

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2) Mechanical (simulation
3) Design explore
4) AUTODYCFX Mes
5) FE Modeler

C. Analysis for MS Roller

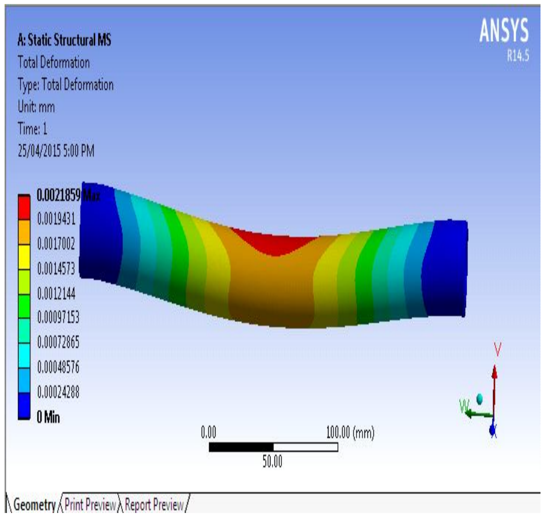

Fig. 4.Deformation developed in MS Roller

Properties	
Volume	1.2515e+005 mm³
Mass	0.98245 kg
Centroid X	2.7889e-015 mm
Centroid Y	150. mm
Centroid Z	1.8569e-015 mm
Moment of Inertia Ip1	7824.1 kg·mm²
Moment of Inertia Ip2	317.67 kg·mm²

D. Analysis for GF Roller

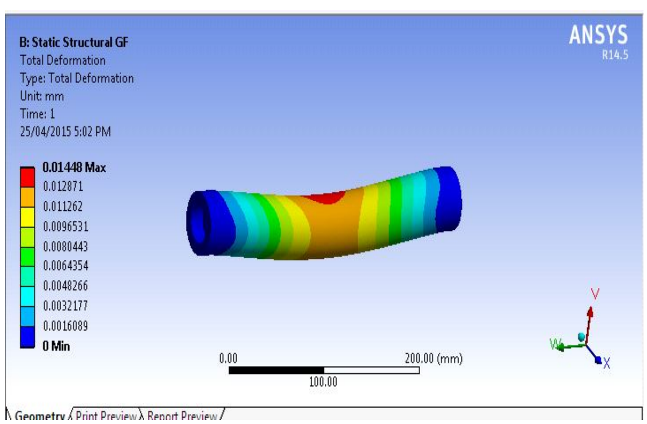

Fig. 5. Deformation In GF Roller

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Properties	
Volume	2.9103e+005 mm³
Mass	0.58206 kg
Centroid X	4.4097e-015 mm
Centroid Y	150. mm
Centroid Z	7.1798e-016 mm
Moment of Inertia Ip1	4562. kg·mm²
Moment of Inertia Ip2	242.23 kg·mm²
Moment of Inertia Ip3	4562. kg·mm²

VI. RESULT

A. Weight Reduction due to Optimization

1) Analytically:

TABLE.3

Design	Weight (Kg) (Analytically)	% Material required compared to existing design	% Material save compared to existing design
Existing	0.98245	100	------------------
Optimized	0.58206	59.24	40.76

Table: Weight reduction due to Optimization Analytically

2) Theoretically:

TABLE.4

Design	Weight (Kg)	% Material required compared to existing design	% Material save compared to existing design
Existing	0.9451	100	------------------
Optimized	0.5725	60.57	39.42

Table: Weight reduction due to Optimization theoretically

B. Stress Analysis of Roller

TABLE.5

Design	Max.Def (mm)	Max.Stress (MPa)
Existing	0.00218	2.1550
Optimized	0.01448	1.1125

Table: Stress analysis before optimization & after optimization

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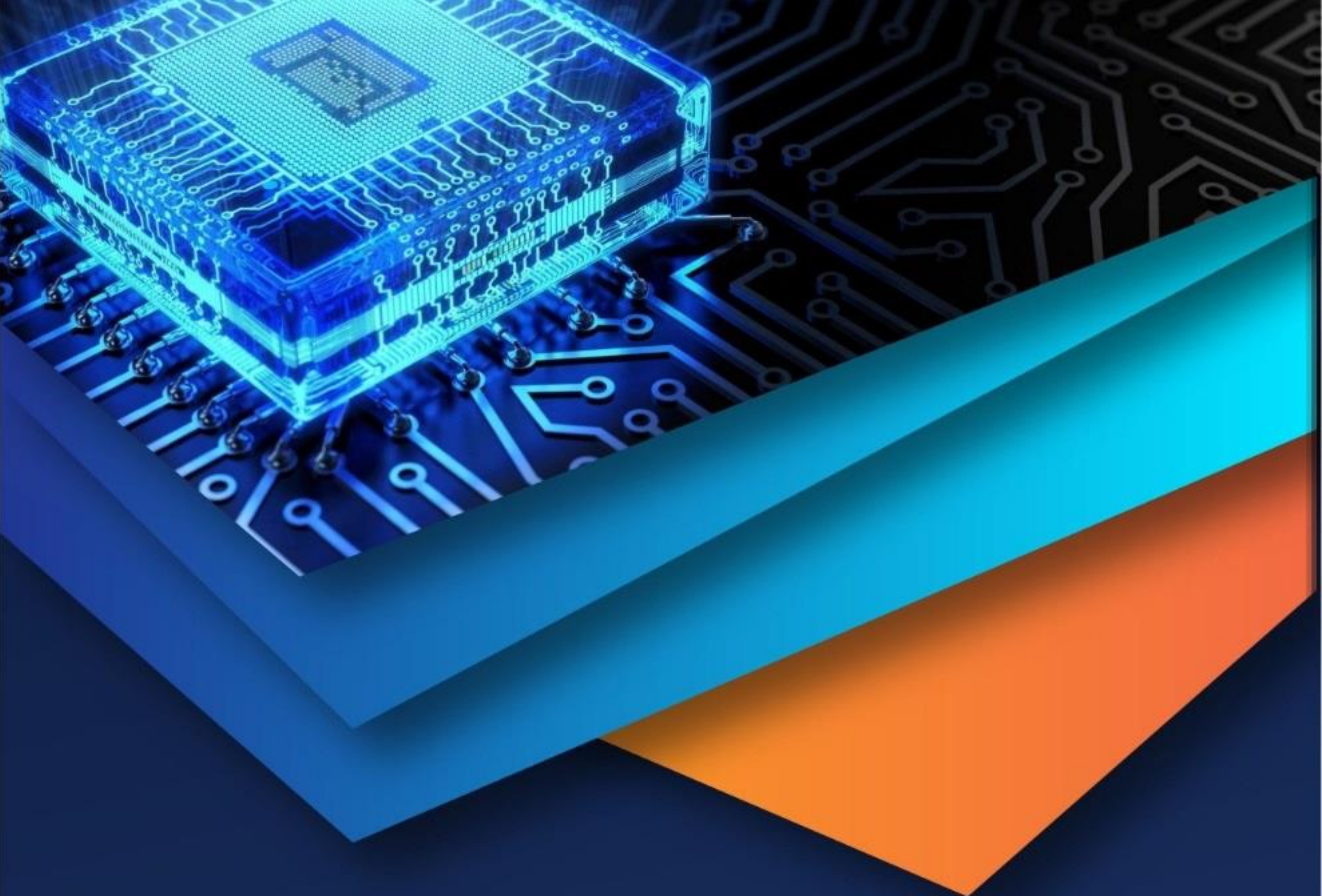

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