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DESIGN, DEVELOPMENT AND OPTIMIZATION OF ROLLER CONVEYOR

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ABSTRACT :- The article highlights study existing conveyor system and optimize the critical parts like Roller, C-channels for chassis and support to minimize the overall weight of assembly and material saving. This work also involves geometrical and finite element modeling of existing design and optimized design. Geometrical modelling will be going to done by using CATIA V5R20 and finite modelling tool. Results of linear static in this work testing on sample will done using a universal testing machine (UTM) otherwise called a widespread analyzer is utilized to test the elasticity and compressive strength of materials. The "widespread" some portion of the name mirrors that it can perform numerous standard elastic and compression tests on materials, components and structures. In this work the composite material is consider for the sample testing for eg. Carbon fibers and GFRC. Paper also involve discussion about comparative study of different composite material and the behaviour of the composite material as per variable loading conditions.

I. INTRODUCTION

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, I-Beam, towline, power & free and hand pushed trolleys. Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide A transport framework is a typical piece of mechanical taking care of gear that moves materials starting with one area then onto the next. Transports are particularly helpful in applications including the transportation of weighty or bulky materials. Conveyor systems a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, IBeam, towline, power & free and hand pushed trolleys. Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide. [1,2]

II. DESIGN

2.1 Design of the parts of roller

E =2.10*105 MPa,
ρ= 7860 Kg/m3 ,
Maximum Stress Calculation for given condition
W= 12.5kg
D1= Outer diameter of roller = 46 mm
D2 = Inner diameter of roller = 40 mm
w = Width of roller = 370 mm
y = Distance from neutral axis = 0.046/2 = 0.023
Considering uniformly distributed load, Maximum Moment (Mmax) = W*L/8 = (36*9.81*.33)/8
Mmax = 5.671Nm Moment of Inertia (I) =Π (D14-D24)/64 = Π (0.0464–0.0404)/64 I = 9.4122*10-4 Kg.m2
Maximum bending stress σb = Mmax * y/ I = 5.6714* 0.023/ 9.4122*10-8 σb= 1.24 MPa Ymax = 5*W*L3/384*E*I = 0.00409
Design of Composite Roller Material E = 43000 Mpa ρ= 2600Kg/m3 ,
Maximum Stress Calculation for given condition W= 12.5kg D1= Outer diameter of roller = 50 mm
D2 = Inner diameter of roller = 40 mm w = Width of roller = 370 mm
y = Distance from neutral axis = 0.050/2 = 0.025
Considering uniformly distributed load, Maximum Moment (Mmax) = W*L/8 = (12.5*9.81*.37)/8
Mmax = 5.67 Nm Moment of Inertia (I) =Π (D14-D24)/64 = Π (0.0504–0.0404)/64 I = 1.81*10-7 Kg.m2
Maximum bending stress σb = Mmax * y/ I = 5.67 * 0.025/ 1.81*10-7 σb = 0.782 MPa Ymax = 5*W*L3/384*E*I = 0.01038 3.

III. ANALYSIS

Meshing is an integral part of the computer-aided engineering simulation process. The mesh influences the accuracy, convergence and speed of the solution. Furthermore, the time

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it takes to create and mesh a model is often a significant portion of the time it takes to get results from a CAE solution. Therefore, the better and more automated the meshing tools, the better the solution from easy, automatic meshing to a highly crafted mesh, ANSYS provides the ultimate solution. Powerful automation capabilities ease the initial meshing of a new geometry by keying off physics preferences and using smart defaults so a mesh can be obtained upon first try. Additionally, a user can update immediately to a parameter change, making the handoff from CAD to CAE seamless and aiding in upfront design.

3.1 Boundary Condition

To define a problem that results in a unique solution, you must specify information on the dependent (flow) variables at the domain boundaries specify fluxes of mass, momentum, energy etc. into the domain. Boundary conditions involves: Identifying the location of the boundaries (e.g., inlets, walls, symmetry) Supplying information at the boundaries. The data required at a boundary depends upon the boundary condition type and the physical models employed

3.2 Results of FEA and meshing on ANSYS

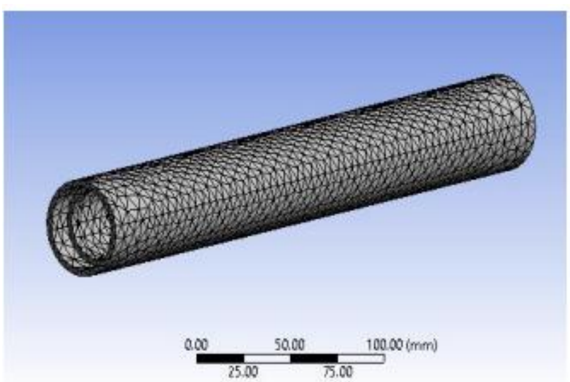

Fig. 3.1 Meshing of Original MS Roller

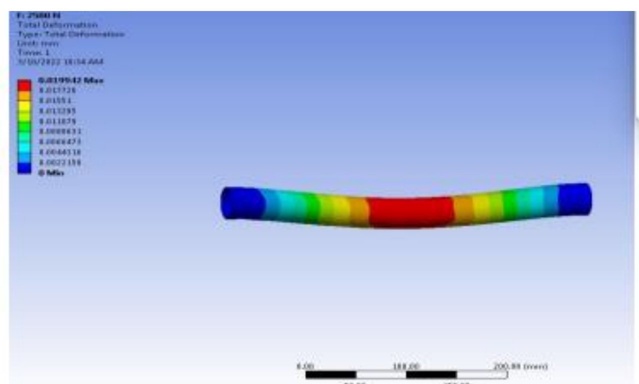

Fig. 3.4 Total Deformation in MS Roller

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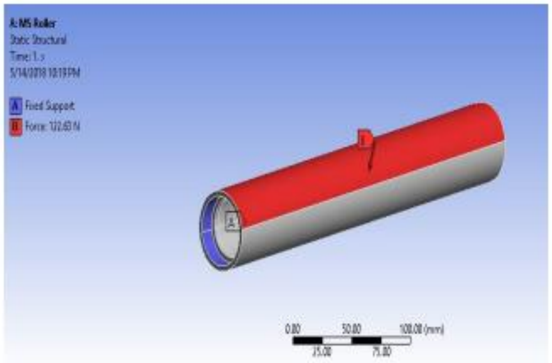

Fig. 3.2 Boundary Condition of MS Roller

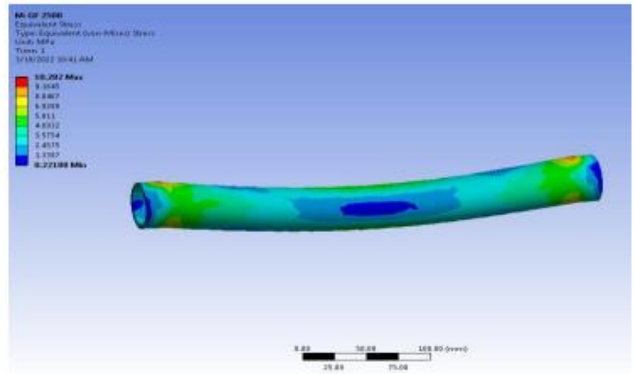

Fig. 3.5 Stress in Glass Fiber Roller

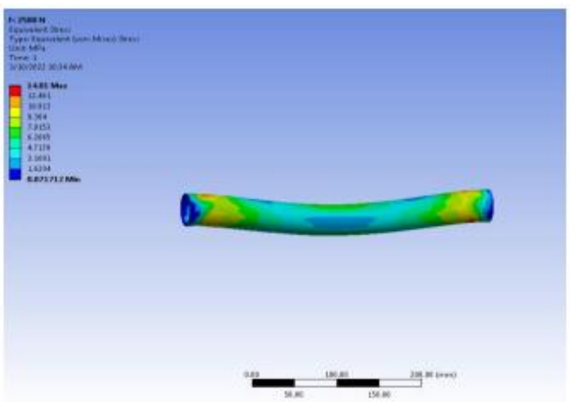

Fig. 3.3 Stress in MS Roller

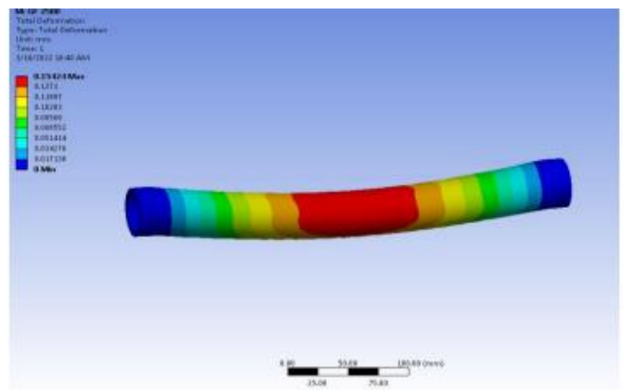

Fig. 3.6 Total deformation in Glass Fiber Roller

IV. RESULT TABLE

Sr. No.	Parameter	Material	FEA	Theoretical
1	**Deflection (mm)**	Steel	0.002	0.00409
2		E-Glass	0.012	0.01038
1	**Bending stress (MPa)**	Steel	1.27	1.24
2		E-Glass	0.71	0.782

Table 4.1 Results of various parameters

V. CONCLUSION

Maximum weight of conveyor is due to roller; existing MS roller conveyor shows maximum weight so there is scope of optimization. Topology optimization technique gives optimum design results for new optimized roller. Increasing strength and inducing weight of products are high research demands in the current innovation. Composite materials are becoming sufficient of satisfying these requests. Composite roller conveyor has high strength to weight ratio for the same load carrying capacity with same dimensions as that of MS rollers. When MS material is used stress is more as compared to glass fiber composite material.

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