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Design & Analysis Of Composite Roller of Roller Conveyor System

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ABSTRACT

The aim of this project is to study existing conveyor system and optimize the critical parts like Roller to minimize the overall weight of assembly and material saving. We used glass fiber as a alternative material for the roller conveyor. Paper also involves geometrical and finite element modeling of existing design and optimized design. Geometrical modeling was done using CATIA V5R20 and finite element analysis was done by using ANSYS 14.5 workbench.. Results of Linear static analysis of existing design of M.S. roller.and composite glass fiber roller design are compared, to prove design is safe. Composite glass fiber roller reduces considerable amount of weight.

Keywords- **Rollers, Glass fiber, Optimization.**

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I. INTRODUCTION

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 it ensue has beans and nuts, bottles and cans, automotive components, scrap metal, pills and powders, wood and furniture and grain and animal feed. Many factors are important in the accurate selection of a conveyor system. It is important to know how the conveyor system will be used before hand. 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.[3]

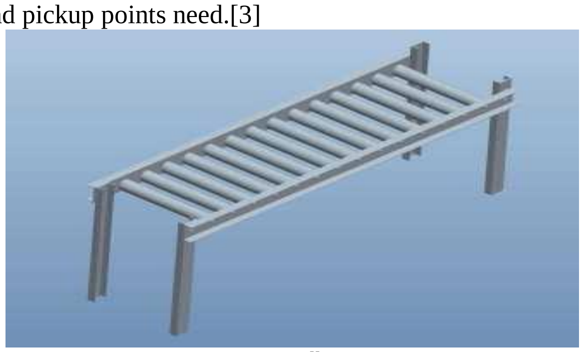

Figure No.1-Roller Conveyor

Composites are used in automotives aerospace ,marineas well as differenindustrial applications.Components of gravity feeding roller conveyor include bearing , shaft,c-channel for stand,c-channel for chassis & roller.Out of these components roller weight is important considering total weight of gravity feeding roller conveyor system. Hence roller is selected & focused. Customer demands like cost saving, energy saving , higher productivity& good quqlity are challenges in market.Composite materials being versatile indifferentapplicatiooffersproperties likegoodcorrosionresistance,higherstrength:weightratio,lowdeflection&highcriticalspeeds.

II.OBJECTIVES OF THE WORK

The following are the objectives of the study:

- Study existing roller of conveyor system.
- Geometry modeling existing roller.
- Analysis of existing roller .
- Modification of critical conveyor part i.e.roller for weight reduction.
- Analysis of Modified design for same loading condition.
- Recommendation of new solution for weight reduction. [2]

III.DESIGN OF ROLLER

3.1 Design of Original Roller
Material – MS

$E = 2.10*105$ Mpa, $\rho = 7860$ Kg/m^3,
Considering uniformly distributed load & FOS = 2
Maximum Stress Calculation for given condition
W= 36kg
D_1= Outer diameter of roller = 46 mm
D_2 = Inner diameter of roller = 36 mm
w = Width of roller = 330 mm

y = Distance from neutral axis = 0.044/2 = 0.023
Considering uniformly distributed load**,**
Maximum Moment (Mmax) = $W*L^2/8$
$= (36*9.81*.33^2)/8$
Mmax = 4.807Nm
Moment of Inertia (I) =Π ($D1^4$ - $D2^4$)/64
$= \Pi\ (0.046^4 - 0.036^4)/64$
$I = 0.13394*10^{-6}$ m4
Maximum bending stress σ_b = Mmax * y/ I
$= 4.807*\ 0.023/\ 0.13394*10^{-8}$
σ_b = 0.5214 Mpa

3.2 Design of Composite Roller

Material – GF
E = 34000 Mpa, $\rho = 2600 Kg/m^3$,
Considering uniformly distributed load & FOS = 2

Maximum Stress Calculation for given condition
W= 36kg
D_1= Outer diameter of roller = 58 mm
D_2 = Inner diameter of roller = 36 mm
w = Width of roller = 330 mm
y = Distance from neutral axis = 0.058/2 = 0.029
Considering uniformly distributed load**,**
Maximum Moment (Mmax) = $W*L^2/8$
$= (36*9.81*.33^2)/8$
Mmax = 4.807 Nm
Moment of Inertia (I) =Π (D_1^4 - D_2^4)/64
$= \Pi\ (0.058^4 - 0.036^4)/64$
$I = 4.72*10^{-7}$ m4
Maximum bending stress σ_b = Mmax * y/ I
$= 3.973 * 0.029/ 4.72*10^{-7}$
σb = 0.6013 Mpa

IV.MODELING OF ROLLER

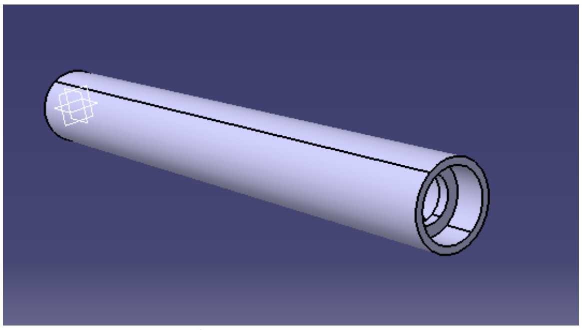

Fig2. CATIA Model of MS roller

V.STATIC ANALYSIS

5.1 M.S. Roller Analysis

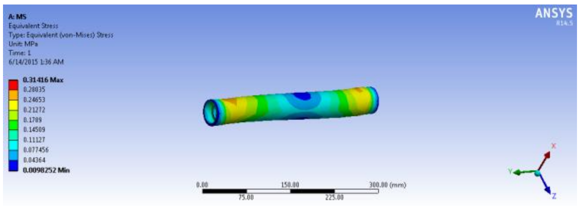

Fig3. M.S. roller Stress

5.2 Glass Fiber Roller Analysis

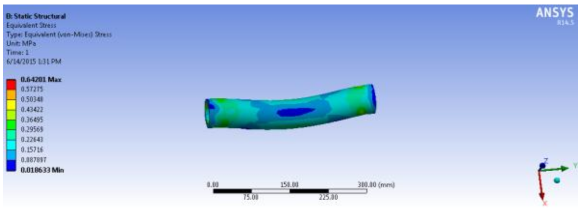

Fig4. GF roller Stress

VI. RESULT

Table no.1-Comparison of M.S.& G.F.Roller

Sr.No.	Material	Hand Calculation(MPa)	ANSYS Result (MPa)	Weight (Kg)
1	MS	0.5214	0.31416	1.71
2	GF	0.6013	0.64201	1.09

CONCLUSIONS

• Existing design calculation shows the factor of safety is very greater than requirement and there is a scope for weight reduction.
• Critical parameter which reduces the weight is roller Material change to glass fiber.
• 38% of weight reduction is achieved due to composite material design.

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