IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684, p-ISSN: 2320-334X
PP 29-32
www.iosrjournals.org

Analysis of Power Transmission System for Ginning Machine with Feeding Mechanism using FEA

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ABSTRACT: *In India, it was found that ginning factories do not operate efficiently with regard to the labour force employed and the amount of capital invested. In order to make a more concrete evaluation of the cotton ginning sector, it is necessary to determine the structural characteristics of the factories, costs and profitability, the level of technical efficiency, and the most important, potential for improvement in the industry. Irregular feeding of Seed Cotton to ginning machine decreases the production rate of seed and fiber. It also affects the quality of the fiber and seed. To overcome these difficulties feeding mechanism is developed. The primary function of feeding mechanism is to feed seed cotton uniformly to the ginning machine at controllable rates. Feed rollers, located at the bottom of the feeder, directly under the hopper, control the feed rate of seed cotton to the ginning machine. Stress analysis carried out by using FEA software and the results are compared with the calculated values. This paper illustrates how the chain drives are very important to carry forwards the power. In this Paper recommendations and suggestions to improve quality of cotton fiber, suggestions for ginning factories are highlighted.*

Keywords: *Ginning machine, Shaft, Chain, Feeding mechanism, Power Transmission System etc*

I. INTRODUCTION

A cotton gin is a machine that quickly and easily separates cotton fibers from their seeds, allowing for much greater productivity than manual cotton separation. The fibers are processed into clothing or other cotton goods, and any undamaged seeds may be used to grow more cotton or to produce cottonseed oil and meal.The cotton gin is a machine used to separate cotton fibers from the seed.

The function of the gin is to separate lint from gin to create two marketable products, fiber and seed. The gin must also be equipped to remove foreign matter, control moisture and remove other contaminants that significantly reduce the value of the bale. The gin's customer is the grower, the one who pays in one way or another to have the cotton ginned. It is the ginner's responsibility to maximize the revenue from every module of cotton.

The primary function of a feeder is to feed seed cotton uniformly to the gin stand at controllable rates. Irregular feeding of lint through the feeder to ginning machine, it decreases the production rate of seed and fiber. It also affects the quality of the fiber and seed. The cotton ginning sector primarily developed during the 1980s and is one of the most important sectors of the economy. This is a base industry of cotton processing.

II. METHOD AND MATERIALS

2.1 Cotton Feeder

The primary function of feeding mechanism is to feed seed cotton uniformly to the ginning machine at controllable rates. Feed rollers, located at the bottom of the feeder, directly under the hopper, control the feed rate of seed cotton to the ginning machine.

2.2 Types of Feeding

(i)Auto feeding (ii) Manual feeding

III. POWER TRANSMISSION SYSTEM FOR COTTON FEEDER

3.1 Chain Drives

A chain is a power transmission element made as a series of pin-connected links is used to transmit power from motor shaft to feeder as shown in fig.1. The design provides for flexibility while enabling the chain to transmit large tensile forces. Most of the time chain is under tension which causes failure of chain assembly which is the major problem for industrial sector. Causes of this failure are improper design. It is important to study the influence of various parameters. All these parameters can be considered simultaneously and chain link design optimally. Optimization is the process of obtaining the best result under given circumstances in design of system. The various loads are considered as tensile load, shock load, chordal action etc,.

3.2. Design of Chain Drives

In designing of chain for power transmission capacity varioud modes of failure have been considered viz. fatigue of the link plates due to the repeated application of the tension in the tight side of the chain, Impact of the rollers as they engage the sprocket teeth, galling between the pins of each link and the bushings on the pins.

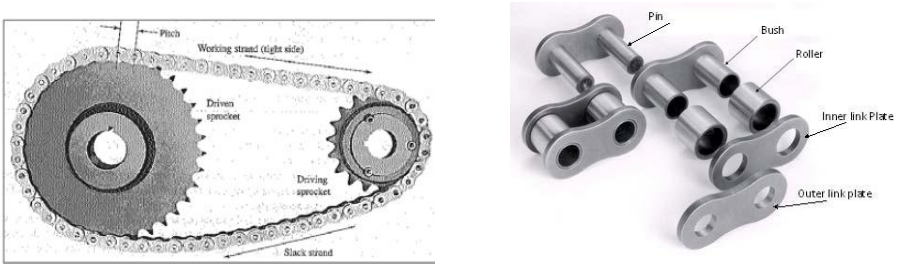
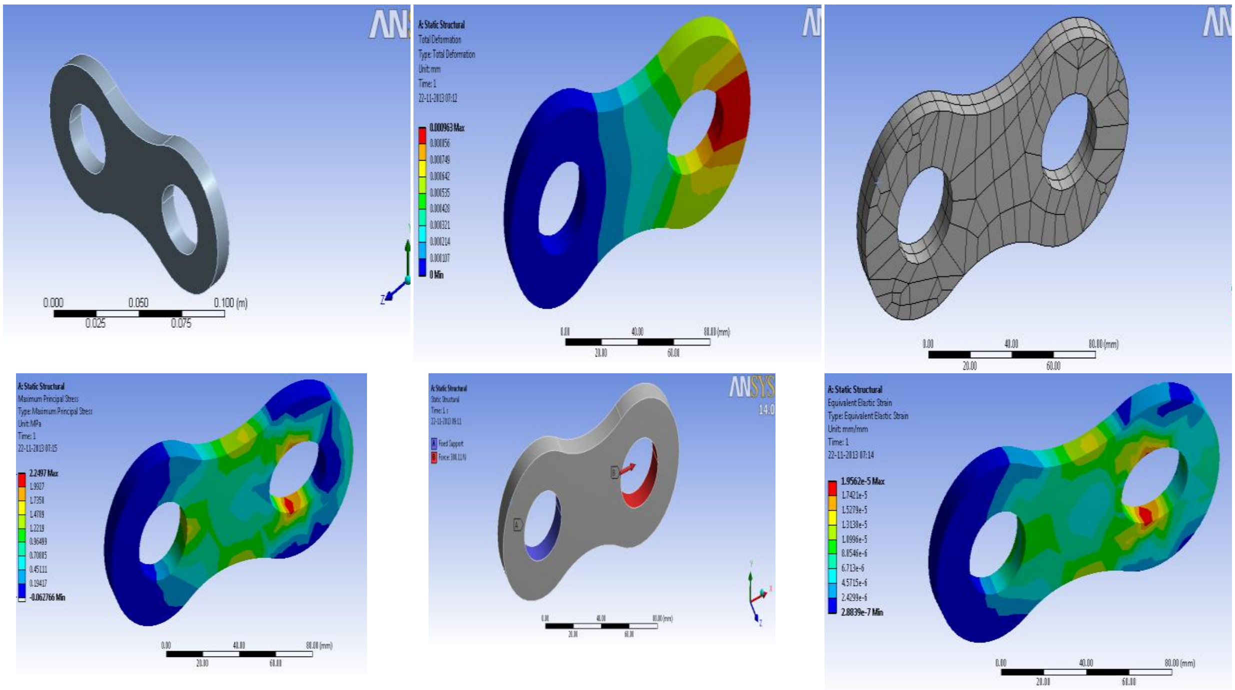


Fig.1: The typical roller chain link assembly.

IV. ANALYSIS OF POWER TRANSMISSION SYSTEM USING ANSYS 11.0 SOFTWARE

ANSYS is general-purpose finite-element modelling package is used to numerically solve problems. These problems include static/dynamic, structural analysis.The ANSYS program has many finite-element analysis capabilities, ranging from a simple linear static analysis to a complex nonlinear transient dynamic analysis. Structural Analysis is available in the integrated mode of Pro/E and analysis can be performed within the Pro/E environment.

V. ANALYSIS OF CHAIN DRIVE



IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
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Type	Total Deformation	Equivalent Elastic Strain	Equivalent (von-Mises) Stress	Maximum Principal Stress	Maximum Principal Elastic Strain
Results					
Minimum	0. mm	2.8839e-007 mm/mm	2.8664e-002 MPa	-6.2766e-002 MPa	1.1454e-007 mm/mm
Maximum	9.63e-004 mm	1.9562e-005 mm/mm	2.121 MPa	2.2497 MPa	1.9743e-005 mm/mm

VI. ANALYSIS OF SHAFT

Shaft 1

Total Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent (von-Mises) Stress	Shear Stress
Results				
0. m	1.7771e-006 m/m	-4.2518e-005 m/m	9293.4 Pa	-1.8269e+006 Pa
7.5731e-005 m	1.0504e-004 m/m	4.2518e-005 m/m	1.1524e+007 Pa	1.8269e+006 Pa

Shaft 2

Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent (von-Mises) Stress
Results				
0. m		2.5333e-006 m/m	-4.2763e-005 m/m	13151 Pa
9.6372e-005 m	9.6365e-005 m	1.3992e-004 m/m	4.2763e-005 m/m	1.5353e+007 Pa

Shaft 3

Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent (von-Mises) Stress
Results				
0. m		3.1014e-006 m/m	-5.3536e-005 m/m	16281 Pa
1.1065e-004 m	1.1064e-004 m	1.7112e-004 m/m	5.3536e-005 m/m	1.8778e+007 Pa

Shaft 4

Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent (von-Mises) Stress
Results				
0. m	-8.1355e-007 m	1.3845e-012 m/m	-2.2391e-004 m/m	0.13337 Pa
2.3099e-004 m		6.5197e-004 m/m	2.0106e-004 m/m	3.6216e+007 Pa

Graphs:

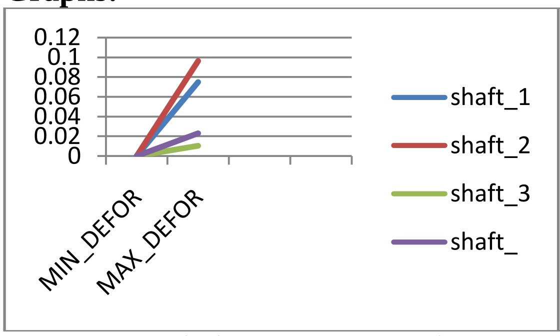


Fig 2: Comparison of deformation between all shafts in mm

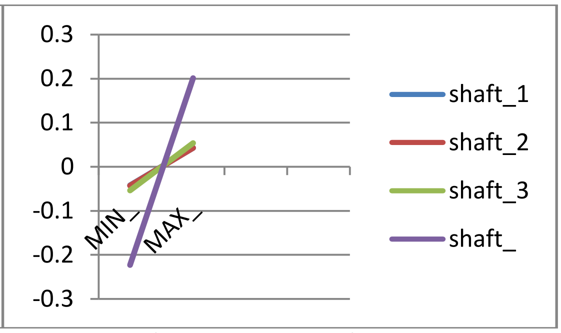
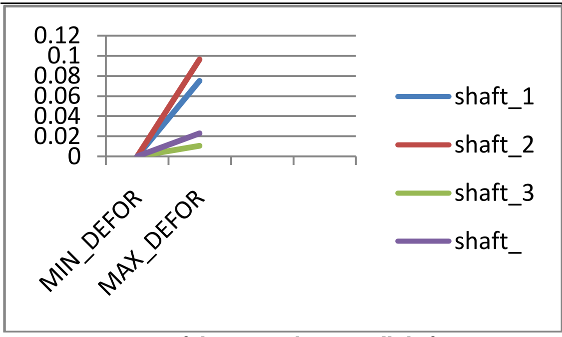


Fig 3 : Comparison of strain between all shafts



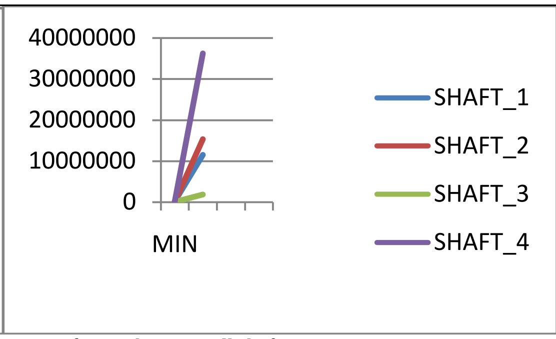


Fig 4: Comparison of shear strain between all shafts Fig 5: Comparison of stress between all shafts

VII. CONCLUSION

Stress analysis carried out by using FEA software and the results are compared with the calculated values. This paper illustrates how the chain drives are very important to carry forwards the power. In this Paper recommendations, suggestions to improve quality of cotton fiber, suggestions for ginning factories are highlighted.

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