

# Performance Evaluation of Pulley Arm Design

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**Abstract**— Here in this study CAD method has been explored to design and analysis of pulley arm and belt, which considered being the main parts of a rod cutting machine. The cutting speed of a present system of pulleys and belt is very low in actual working conditions. The ultimate aim of the project is to increase the cutting speed. Finite Element Analysis was done for investigation of stresses experienced by the pulley. Finite Element Method (FEM) is used to determine the BM shared by the arms for its different angular positions. The distribution of bending stress in the arms is also obtained. Finally, the design modifications have been suggested the parameters, By using this parameters the new design is developed which is able to give the cutting speed which is required for the actual working conditions. The results showed that stress experience by the pulley is less than the young's modulus of the material. This ultimately enhances the life of the pulley and belt. It is also observed that the total deformation is very less and not crossing the bounding box limits. Hence part is safe.

**Key words:** CAD Method, Pulley, FEA, Stress Analysis

## I. INTRODUCTION

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a cable or belt along its circumference. Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power. In nautical contexts, the assembly of wheel, axle, and supporting shell is referred to as a "block." A pulley may also be called a sheave or drum and may have a groove between two flanges around its circumference. The drive element of a pulley system can be a rope, cable, belt, or chain that runs over the pulley inside the groove.

A flat belt drive is designed by limiting the maximum tension  $T_t$  according to the permissible tensile stress specified for the belt material. Pulley material is generally cast iron or cast steel.

Different types of pulley systems:

### A. Fixed:

A fixed pulley has an axle mounted in bearings attached to a supporting structure. A fixed pulley changes the direction of the force on a rope or belt that moves along its circumference. Mechanical advantage is gained by combining a fixed pulley with a movable pulley or another fixed pulley of a different diameter.

### B. Movable:

A movable pulley has an axle in a movable block. A single movable pulley is supported by two parts of the same rope and has a mechanical advantage of two.

### C. Compound:

A combination of fixed and movable pulleys forms a block and tackle. A block and tackle can have several pulleys

mounted on the fixed and moving axles, further increasing the mechanical advantage.

## II. STRESS ANALYSIS

Stress analysis is the complete and comprehensive study of stress distribution of specimen under study. The most important task before design, engineer is to maintain the working stresses within predetermined specific limits, in order to avoid the failure of a member. The design has to be economical with adequate mass and inertia. To improve the product quality, it is necessary to determine the stresses in various components. It is also necessary to know the stress distribution in order to predict the failure of component. This puts the design engineer into indispensable need for stress analysis.

### A. Purpose of Pulley Stress Analysis

Purpose of pulley stress analysis is:

- To avoid failure of pulley.
- To avoid breakage of belt.

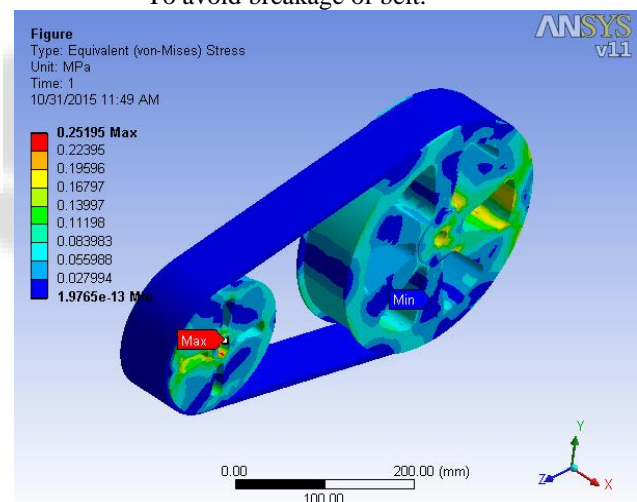


Fig. 1: Stresses in pulley

## III. REASONS OF FAILURES

There are various reasons, which could affect a pulley belt system. The safe design can provide protection against some of this failure by performing stress analysis according to ansys software.

- 1) Total deformation beyond the bonding box limit.
- 2) Equivalent stress produces is more than young's modulus
- 3) Von misses stress crossing the specified limit.

## IV. DESIGN OF PULLEY

Pulley is designed by considering the speed which is required. Accordingly parameters taken by the design data book for safe design of pulley.

