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Design and Analysis of Lifting Block for Car Transporter Trailer

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Abstract - *With the growing worldwide trade, container terminals have grown in number and size. To increase operational efficiency, many new terminals are now automated. The key focus is on improving seaside processes, where a distinction can be made between single quay crane operations (all quay cranes are either loading or unloading containers) and overlapping quay crane operations (some quay cranes are loading while others are unloading containers). Using a network of open and semi-open queues, we develop a new integrated stochastic model for analyzing the performance of overlapping loading and unloading operations that capture the complex stochastic interactions among quayside, vehicle, and stackside processes. The analytical model is solved using an iterative algorithm based on the parametric decomposition approximation approach. The system performance is tested at varying container traffic levels. We find that the percent absolute errors in throughput times compared to simulation are less than 10% for all cases. Using these integrated models, we are able to generate design insights and also rapidly analyze what-if scenarios. For example, we show that the best yard layout configurations for single (either loading or unloading) operations and the best for overlapping (both loading and unloading) operations largely overlap. The best configurations have relatively few stack blocks and many rows per block.*

***Key Words*: Lifting Block, Analysis, Car Transporter Trailer, Design, etc.**

1. INTRODUCTION

A lifting operation is an operation concerned with the lifting and lowering of a load. Field service has requested that to require unique lifting tool to lift every engine family blocks, while using this lifting tool, need to change only bolt size and washer as per weight of engine block. So design of lifting tool should be as per ASME_BTH- 1(Below Hook Lifting Devices). Gaurav Bhusari and M.Sohail and Pervez1carried out the strength and fatigue analysis on the fixture bracket for the safety of the operator and production system. Gayan Rathnaweera2, find out the weight carrying capacity of Lifting Bracket using Finite Element Method. Sontake3 in his study explained that the engine mounting plays an important role in reducing the noise, vibrations and harshness for improving vehicle ride comfort. The brackets on the frame that support the engine undergo high static and dynamic stresses as well as huge amount of vibrations. P.D. Jadhav and Ramakrishna 4 in their study the existing model were optimized and a novel model was proposed to reduce the weight of the rib of the engine mounting bracket. Pramod Walunje and V. K. Kurkute5 carried out analysis using that ANSYS software and found out the optimized volume of engine bracket results in saving structural weight.

1.1 Geometry

A lifting block is a system of two or more pulleys with a rope or cable threaded between them, usually used to lift heavy loads. The pulleys are assembled together to form blocks and then blocks are paired so that one is fixed and one moves with the load. The rope is threaded through the pulleys to provide mechanical advantage that amplifies the force applied to the rope.

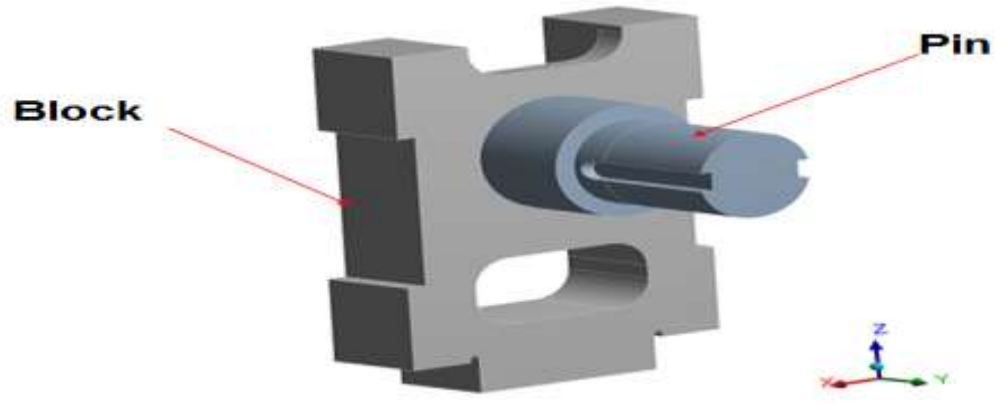

Figure1 Lifting Block

2. MATERIAL USE

EN8 and EN18 materials is used, EN8 carbon steel is a common medium carbon and medium tensile steel, with improved strength over mild steel, through-hardening medium carbon steel. EN8 carbon steel is also readily machinable in any condition. EN8 steels are generally used in the as supplied untreated condition. But EN8 steels can be further surface-hardened by induction processes, producing components with enhanced wear resistance. Steel EN8 materials in its heat treated forms possess good homogenous metallurgical structures, giving consistent machining properties.

Table-1: Material Properties

Name	Density (Kg/m^3)	Young's Modulus (MPa)	Poisson Ratio (MPa)
EN18	8080	2e5	0.3
EN08	7850	2e5	0.3

3. RESULT AND DISCUSSION

We use two different type of material i.e. EN8 and EN18. Analysis is carried out for load 4KN as result stress level is higher than yield strength of in EN18 material so not meeting acceptance criteria. So lifting tool is designed in such way that to reduce stress level for that contact area between Block and Key Analysis of Lifting block carried with material of EN8.

3.1 Meshing

The geometry is discredited in to finite number of elements using FEA methods.

Node: 120816

Element: 35284

Fig-2: Lifting block Meshing

3.2 Boundary Conditions

For the both material i.e. EN8 and EN18 applying the load of 4Ton, So following are boundary conditions.

Load = 4 Ton

= 4000 Kg * 10 m/s^2 (Gravity)

= 40000 N

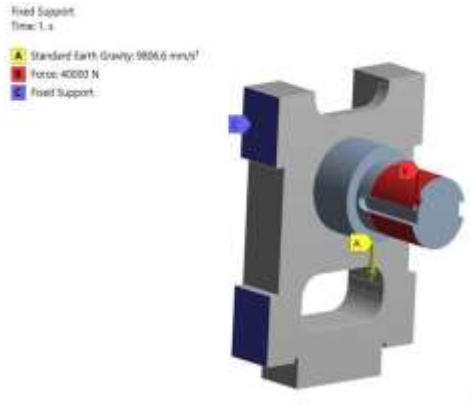

Figure3 Boundary conditions

3.3 Analysis Results

Analysis results shows, Total deformation, Equivalent stress in key and Equivalent Stress in Block for both material.

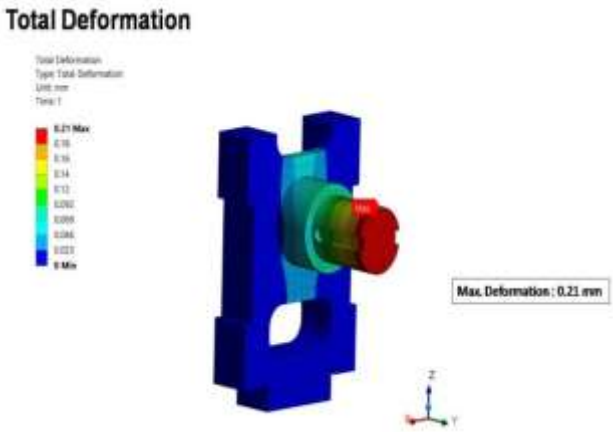

Figure4 Total deformation

Figure5 Equivalent Stress in pin

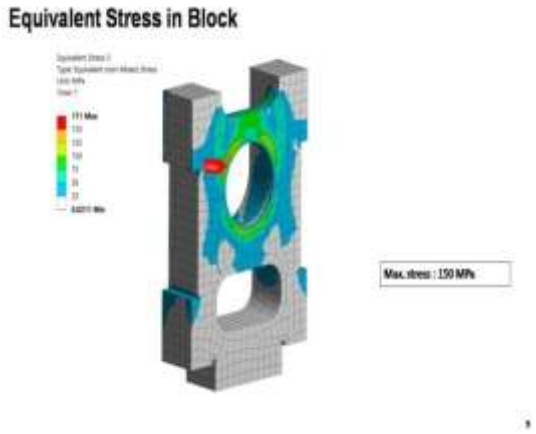

Figure6 Equivalent Stress in Block

Figure7 Equivalent Stress in lifting block

3. CONCLUSIONS

The maximum deformation of 0.12 mm was observed on pin, the maximum equivalent stress of 254 Mpa was observed in pin and it is above its allowable limit of 241 MPa (EN18 material), hence it can be concluded that pin is failed for applied loading. If we change material to En8 material its strength is 465 MPa and it will pass above stress limit of pin, hence it is suggested to change existing material to En8 material.

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