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Comparative Study of Jib Crane

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ABSTRACT:. A jib crane is a boom with a moveable trolley hoist. The trolley hoist moves along the length of the boom and the boom swivels allowing the lifted load. We going to anaylze the cantliver beam with different point load condition. That mean we going to analyze static strucutral capability of the jib crane with various point load condition. Based on holding time, load and length of the crane the shear force and bending moment of the structure will varying, here we used contiliver beam with various point load with constant time and length of the crane. In engineering and design, deformation refers to the alteration of a structure's shape due to applied forces or stress. Explicit deformation analysis is crucial in assessing how materials and structures respond to these forces, ensuring safety, functionality, and longevity. The fundamental principle is to solve the equations of motion using explicit time integration, which calculates the state of the system at each time step based on the previous state. This method is highly efficient for complex, nonlinear problems with large deformations, providing detailed insights into the behavior of materials and structures under stress.

I. INTRODUCTION

Today's Industry demands versatile, efficient and cost effective equipment while at the same time providing more flexibility along with significant savings through increased productivity. A jib crane can help to improve material handling efficiency and work flow. Serious consideration should be given to jib cranes for applications requiring repetitive lifting and transferring of loads within a fixed arc of rotation. The need of continual improvement in material handling technologies is a common feature of many modern engineering endeavors. The purpose of this research is to optimize the deflection of the Jib crane without influence to ergonomically feature of easy maneuvering in an extremely cost sensitive market as modeling and then analysis. Objective of the research is to develop calculation methodology for optimization of jib cranes and to investigate various analytical calculation methodology develop various calculation for pillar mounted over braced jib cranes. The project involves development of mathematical modeling C++ based on En 13001 which emphasis on limit state theory. The algorithm is developed so that user can enter various height of the pillar and outreach. The program will calculate whether the jib crane suffice stiffness ratio which is required as per the application demand. The calculations are done at various angles of the Jibs and position of the loads on the Jibs**.**

In engineering and design, deformation refers to the alteration of a structure's shape due to applied forces or stress. Explicit deformation analysis is crucial in assessing how materials and structures respond to these forces, ensuring safety, functionality, and longevity. This report delves into the principles, methodologies, and applications of explicit deformation in design, with a focus on finite element analysis (FEA), material properties, and case studies from various engineering disciplines.

II. LITERATURE REVIEW

A literature review on jib cranes typically covers various aspects such as design, applications, safety, and advancements. Studies often delve into the structural analysis, load capacity, and materials used in jib crane construction. Research may explore the historical development of jib cranes and how design innovations have improved their efficiency.Safety considerations, including standards and regulations, are crucial components of the literature review. This involves examining accident reports, safety features, and guidelines to ensure that jib cranes adhere to industry standards.The review might also touch on real-world applications of jib cranes across different industries, highlighting their versatility and role in material handling. Emerging technologies, such as automation and smart controls, may also be discussed in the context of jib crane literature.Overall, a comprehensive literature review

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would provide a well-rounded understanding of the current state of jib crane technology, its historical evolution, safety considerations, and potential future developments.

Relevance to current Research

1) Mr.FaudHadzikadunic, Mr. Omer Jukic, Mr.FaudHadzikadunic, Mr.FaudHadzikadunic, Mr.Faud Had- A broader Assessing methodology for construction and static-Dynamic behavior of a certain crane type – offered Here is a jib crane – is presented in this research. This methodology is applicable to other types of Cranes; however, applying computation numerical Methods and CAD technology to these complex Constructions is critical, as it allows for the most up-To-date access to actual design and constructive Diagnostics. An effective methodology for Calculating and designing a genuine model of jib Crane construction is provided in this research, with The ultimate goal of local and global structure Optimization using CAD technology. The outcomes Of dynamic static analyses of complicated Configuration behavior can be extremely useful. The Significance of significant progress. This research Resulted in a new structural idea for a jib crane with Improved static and dynamic parameters in the same Area. Several objectives are fulfilled by changing the Geometry of the structure.

Relevance to current Research

2) Gerdemeli, S. Kurt K., and B. Tasdem -JIB cranes have been studied, which are Commonly utilised in ship repair and manufacturing Procedures. The findings of the analytical Computation were compared to the results produced Using the finite element approach. The reliability of The finite element method for JIB crane design has been investigated in this way. As a result, it has Been determined that F.E.M is the most trustworthy And practical method for use in the design of JIB Cranes. Finally, the findings of the analytical Computation were compared to the results produced Using the finite element approach. And it was Discovered that the error margins were produced Between the permissible boundaries, based on these Comparison results.

Relevance to current Research

3) Subhash N. Khetre, S. P. Chaphalkar, ArunMeshram- In this paper, the method of final Designing of column Bracket and boom for Material Handling jib crane system. For some characteristics Of jib cranes, such as yield deflection of column, the Basic functions are determined. Stress and Displacement studies were used to determine the Bracket, strength, and boom. It necessitates the Transportation of large, difficult-to-move loads. Solid Works and COSMOS are employed in the Column Bracket and Boom analysis, which is carried Out in two load phases. Jib crane is design, analyze And develop from three most prevalent materials

Relevance to current Research

4)AjinkyaKarpe, SainathKarpe, AjaykumarChawrai -In this paper, author has Selected jib for analysis since we wanted to validate The use of ANSYS (FEM method) for structural Design of Tower Crane Jib. The jib model was Created in ANSYS 14.5 workbench and examined There as well. The axial force and deformation Created in members of the Tower Crane jib were Compared first, and the superior model was chosen For further investigation. The load was applied at the End of the tower crane's jib throughout the analysis To generate the maximum moment and stresses in The jib. Initially, the ANSYS 14.5 results for the jib Were validated using an analytical method. Because The components' permitted stress of Material (Structural Steel) is more than the jib's computed Stress values. According to I.S regulations, the Permissible stress of Material (Structural Steel) of the components is observed, and the jib crane is Safe. The findings of the analytical and FEA(ANSYS) models are fairly similar. The outcomes Demonstrate that the boundary conditions were set Correctly**.**

Relevance to current Research

8) Soniya Patil, Rutuja Wani ,Sudhakar Umale- The crashworthiness of a car determines its structural integrity. The increasing importance of the safety of a passenger car has become a relevant field of study in terms of passenger safety, frame analysis, and material selection. With the advent of Material Sciences and Composites, selecting an appropriate material has become difficult. Composites offer higher structural strength without increasing weight. The possibilities in terms of use in the automobile industry thus widen and open a broader scope of the analysis. Over the years, various studies have been conducted on the strength of frame or material analysis in different passenger car components. Studies have been mutually exclusive and are yet to offer a conclusive material for broader application in car frames and improvement of its strength. Another reason for the improvement in structural strength is the safety of the driver and pedestrian. This factor makes suitable simulations essential for better analyses of the selected material.

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Relevance to current Research

7) van Dooren, E., Boshuizen, E., van Merrienboer, J., Asselbergs, T., & van Dorst, M - Doing and making explicit Traditionally the 'designerly way of thinking' (Cross 2007) is learned in the studio. Designing is learned in a kind of master-apprentice system, or in educational terms: in a process of learning-by-doing. In his studies on the architectural studio Scho¨n (1985, 1987) pointed out the paradoxical character of design education. He stated that the student ''is expected to plunge into the studio, trying from the very outset to do what he does not yet know how to do, in order to get the sort of experience that will help him learn what designing means'' (Scho¨n 1985: p. 57). For the student this is a confusing situation. The teacher faces a similar problem. In principle, the teacher is an expert designer. However, in general, performing a skill like designing is largely an implicit activity (Dreyfus and Dreyfus 1986; Lawson 2006; Ryle 2002). For experienced designers it is often difficult to make explicit what they do and how they do it. Scho¨n (1985, 1987) refers to this as ''knowing-in-action'', addressing the phenomenon that relevant knowing is only available by doing rather than thinking.

III.METHODOLOGY OF PROPOSED SURVEY

Study of structural jib crane :

The study of structural jib cranes involves examining their design, materials, and mechanical components to ensure stability, safety, and efficient load handling. Engineers consider factors such as load capacity, working radius, and environmental conditions to optimize the crane's structural integrity. Analysis of stress distribution, material strength, and connection points are crucial in ensuring the crane meets safety standards and performs effectively. Additionally, studies may involve assessing the impact of dynamic loads, fatigue, and potential wear and tear on the crane's structure over time.

A jib crane structure involves examining its components, such as the jib arm, boom, and supporting framework. Understanding the materials used, load-bearing capacities, and mechanical features is crucial. Additionally, investigating safety measures, installation requirements, and operational considerations is essential for a comprehensive analysis.

Literature review of jib crane:

The review might also touch on real-world applications of jib cranes across different industries, highlighting their versatility and role in material handling. Emerging technologies, such as automation and smart controls, may also be discussed in the context of jib crane literature.Overall, a comprehensive literature review would provide a well-rounded understanding of the current state of jib crane technology, its historical evolution, safety considerations, and potential future developments.

3D Modelling

Creating a 3D model of a jib crane typically involves using specialized software like AutoCAD, SolidWorks, or Blender. You'll need to design the components such as the boom, mast, and hoist, ensuring accurate dimensions and structural integrity. Consider consulting specific software tutorials or hiring a professional if needed.Start by creating basic shapes for the crane components, such as the mast, boom, and hoist. Pay attention to dimensions and proportions. Utilize features like extrusion and rotation to shape the parts, and connect them appropriately. Add details like joints, supports, and fixtures to ensure structural accuracy. Don't forget to refine the model for a realistic appearance.

Finalizing boundry conditions:

Finalizing boundary conditions and conducting force analysis for a jib crane in 3D modeling involves specifying how the crane interacts with its surroundings and determining the forces acting on its components. •1)Boundary Conditions:Fix the base or mounting point of the jib crane to represent a stable connection with the ground.Constraints on rotational and translational movements at the base, mirroring the physical constraints of the crane's installation

Force Analysis :

Identify external forces acting on the crane, including loads lifted by the hoist and any additional applied loads.Consider the weight of crane components as well as the load, ensuring realistic distribution of masses.Analyze

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forces transmitted through structural elements like the mast, boom, and hoist connections.Account for dynamic forces during crane movement, such as inertia and acceleration forces..

Explicit dynamic:

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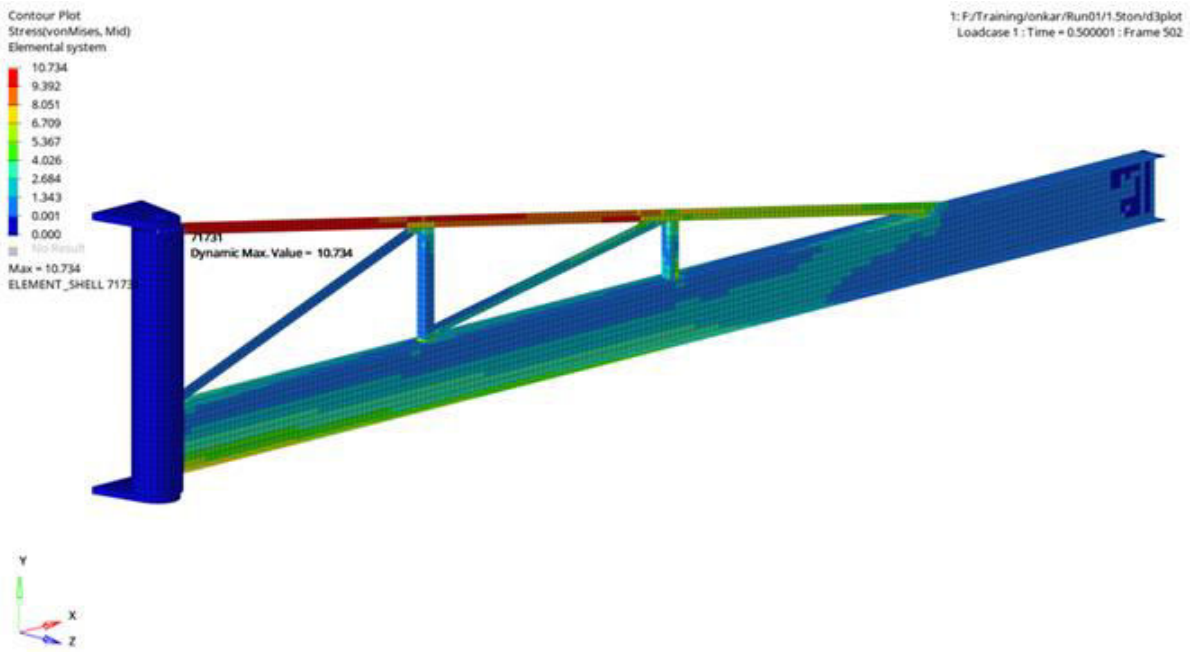
Static :

Without Resisting Force Initially, we shall neglect the forces associated with the inertia of the links and the resisting forces. Later, we shall include the resistive forces and consider the inertia effects. Static force analysis makes direct use of static force equilibrium equations.

Analysis By Static Structural Method:

A moment M is the measure of the tendency of a force F to rotate an object about an axis at distance d from the point to the line of action of the force and is expressed as M = F x d.To fully describe rotational motion and rotational velocity, factors such as the moment of inertia and angular acceleration should also be considered. The absence of any velocity simplifies the analysis by ignoring or simplifying dynamic considerations.

IV.ANALYSIS AND RESULT



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Sr No.	Load (ton)	Deformation (Static)	Deformation (Explicit)	Stress (Static) (N)	Stress (Explicit) (N)	Strain (Static)	Strain (Explicit)
1	0.5	0.00000252	0.00000310	4.068	6.002	0.009	0.015
2	1	0.00000504	0.00000594	1.1816	1.1902	1.68e-10	1.72e^10
3	1.5	0.00000756	0.00000804	2.724	2.814	2.522e-9	2.851e^9
4	2	0.00001008	0.00001120	3.632	3.728	3.36e-9	4.45e^9
5	5	0.0000522	0.0000624	9.080	9.095	8.40e-9	9.25e^9

V.CONCLUSION

It is observed that the Analytical values for all the load are less than the respective mathematical values.
Structural and failure analysis of jib crane structures is crucial for ensuring the safety, reliability, and efficiency of these essential industrial tools. Jib cranes are commonly used for material handling tasks in various industries, including construction, manufacturing, and shipping. These cranes consist of a horizontal boom (or jib) that supports a movable hoist mechanism, allowing for the lifting and transportation of heavy loads within a limited radius. In conclusion, structural and failure analysis play a critical role in ensuring the safety, reliability, and performance of jib crane structures. By comprehensively evaluating the structural integrity of crane components, identifying potential failure modes, and implementing preventive measures, engineers can mitigate risks, prolong the service life of cranes, and enhance operational efficiency in industrial environments. Continued research and advancements in structural analysis techniques, materials science, and monitoring technologies will further contribute to the improvement of jib crane design, maintenance, and safety standards.

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