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# Hook Design Loading by The Optimization Method With Weighted Factors Rating Method

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**Abstract**

This study aims for 2-ton lifting hooks designed to be the appropriate size for using. Both of the cost, the strength, the security and the aesthetics by using the optimal designed method together with the highest weight method. In this study is divided a methodology to design the hook into three-step processes. The first step is to create a lifting hook by ISO 7597: 2013 standard (Forged Steel Lifting Hooks with Latch, Grade 8) to be an initial lifting hook. Then analyzed the axial load of 2 tons by the finite element method. The second step is to analyze by the optimal design to design the lifting hook with the higher safety value by the weight of the lifting hook remains the same or difference. The third step is to analyze the results of the second step by deciding on proper lifting hooks by highest weight method for sizing of the lifting hook. The results of the analysis showed that lifting hook that has been designed by the method presented in this research can be able to reduce the production cost of the materials by 27.5 percents per piece with increasing the safety equal to 42.16 percents. It is good looking and can be easily produced by comparing with the initial lifting hooks.


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*Keywords:* Hook, Finite Element Analysis, Optimization Method.

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## 1. Introduction

There is a higher business competition. The equipment performance is very important to development to be safety and accident reduction. Crane Hooks are kind of equipment and the components which are generally used to elevate the heavy load in industries and constructional sites, the reason why are on favorite in factories. Material handling system equipment mainly import from abroad. The industrial manufacturing requires the professional of material structures for designing and analysis who has an experience and expertise. Now the engineering analysis program to get involved and advantage. The analysis program result is very high accuracy based on material shape of a work piece, reinforcement and the capabilities of the analysis program.

Finite element method has become a powerful tool for numerical solution to analysis the length of camshaft to preparing forging with the minimize force by the factory dimension design (1) time reduction from the forging process. There are design and simulation processes from analysis program to confirm a complete result as filling the material and shape of the work piece. When forging work piece experimental and analyze the result with mold process then the results are consistent. In the customization of raw material size reduction as 50% and mold adjustment cost reduction 25% have effective to products properly. (2) because that allow for determine of conditions (3) to the mold design is more accurate and advantage.

This research of crane hooks are according to ISO 7597: 2013 (Forged Steel Lifting Hooks with latch, grade 8) to analyze and development safety factor under the condition of weighted Factors are remained the same or less then divided 2 phases. The first step is analysis by Computer-Aided Design (CAD) and Computer Aided Engineering (CAE) technology. Based on the Finite Element Analysis method compatible with the Optimum Design approach and analyze the results. The second step is analyzed of the first step result by Weighted Factors Rating Method.

## 2. Methodology

At the implementation of research for crane hooks design analysis can reduce the production cost and apply by the Finite Element Analysis method compatible with the Optimum Design approach. This is an accuracy option, fast and non-waste consumable for experiment. There are 4 main steps that are :

For this experiment we study a 2 tons crane hooks compatible with the eye type chain that produced by forging method. Material standard AISI 4340 or DIN 34CrNiMo6 as a high carbon steels and property is resistant to corrosive. The chemical composition and mechanical properties according to standard as J. D. Costa, 2001: 70 Finite element analysis of an approximation model for crane hook from Solid Works 2013 by creating a 3D standard work piece. The analysis scope that allow by crane hooks material as AISI 4340, Fixed Geometry grip design for lock the position that can not move. Define 19620 N or 2 tons force applied to crane hooks at the center of the curved surface.

From investigated results of the finite element method. To find the actual sizes according ISO 7597: 2013 (Forged Steel Lifting Hooks with latch, grade 8).

The purpose is to improve the crane hooks efficiency of strength by Soild Works 2013 with the same weight or less. There are 2 steps: Define the design variables to create the optimize crane hooks design process following the Fig. 1.