CRANE HOOK MODELING AND SIMULATION WITH OPTIMIZATION ON VARIOUS MATERIALS

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Abstract: Hook is a component which will plays a vital role in many Industries like Manufacturing, Aeronautical, marine, Transport and constructions industries. The aim of Crank hook is to lifting and transferring heavy loads when loading and unloading. At the time of lifting loads hook will subjected to Stress and strain concentration and undergoes deformation. When the continuous loading and unloading the crank hook gets deformation and which will cause failure. At the time of designing crank hook mainly focused on the material, dimension and cross section. From the above mentioned three factors this project focused on the selection of material and optimization of material. Generally the crank hook was designed by different cross sections like Trapezoidal, Rectangular, Square, Circular and Triangular. Hook was manufactured by using Forged steel, and structural steel. But in this project we introducing some alloy steel materials like Wrought iron alloy and Mangalloy for choosing better material. According to curved beam theory trapezoidal cross section is best among the other cross sections for designing the crane hook. Initially the bed diameter of hook is taken from the Winkler-bach's formulae of curved beam theory. Then remaining Specifications (Parameters) considered approximate values for safe design of hook at the load of 600KN. In this project hook model is compared with different materials and optimization of material which is done by using NX NASTRAN software. Hook model design in Uni-graphics and Analysis of stress and deformation is done by using NASTRAN by applying load 600KN on Crane hook.

IndexTerms **- Hook, Trapezoidal cross section, Winkler-bach's formulae, Forged steel, Wrought iron alloy and Mangalloy, Stress and deformation. Uni-graphics and NX NASTRAN.**

I INTRODUCTION

Crane hook is extremely very important part used for lifting serious load with the assistance of chain or links. Crane hook area unit wide victimisation in industries like aeronautic, Marine, Agriculture, Chemical, nuclear energy plant, Thermal powerhouse, nuclear energy plant and Constructional works etc for holding and shifting Brobdingnagian hundreds from one place to a different place. Hook is essentially a hoisting fixture designed to have interaction a link or ring of a lifting chain or the pin of a cable socket or shackle and should follow the health & safety guide lines. Thus, such a really necessary part in Associate in Nursing business should be factory-made and designed in such away on deliver most performance while not failure. These area unit extremely liable Accessories and area unit perpetually subjected to failure because of the number of stresses elicited in it which might ultimately cause hook failure.so as minimize the failure of crane hook; the strain concentration within the hook should be studied. Failure of a crane hook primarily depends on 3 major factors these area unit Dimension, Material , Overload .This project is bothered towards dynamical the fabric of the hook at the constant safe load and constant cross sectional dimensions of the 3 completely different sections .The selected sections area unit triangular, rectangular ,Trapezoidal and quadrangle. The hook space whereas dynamical the cross section of the 4 completely different sections. The main topic of this study is most stress concentration and deformation estimation of best cross section of constellation hook. Our estimation is to acknowledge the tendency at the different load condition. at first we have a tendency to examine the utmost stress and deformation of crane hook for trapezoidal cross section of hook for safe style of hook and so examination these results with different material by simulation analysis. at first the model is ready in NX-CAD completely different cross sections by getting ready the flight with the parameters taken from the planning information book. during this project results of Ansys is compared with the advanced simulation of NATRAN with constant space of cross section of hook of other alloy materials considering in this paper.

HISTORY

Movement cranes of the hand operated sort were offered in use since 1880's. regarding this point sophisticated styles of power-driven motion operated were offered by English and yank Engineers and builders, that involve a driving shaft on the runway and multiple clutches for transferring the facility from the driving shaft to the hoist, trolley car or bridge motions. subsequently in every and each business there serious masses lifting conditions the appliance crane hooks square measure takes place. when numerous years there's immense changes square measure takes place in engineering applications furthermore as industries. the event of a hook could be a long method which needs range of tests to validate the look and producing variables. In fact, the there's numerous applications of crane hooks a number of them square measure represented as bellow. use has been enabled the automakers to scale back development price and time at identical time up the protection, comfort, and sturdiness of the Crane hook they turn out. Excavators having a crane-hook square measure largely utilized in construction works website. One reason is that in work websites wherever the Crane trucks for suspension work aren't offered owing to the minimum area of the site; associate degree excavator has superior instrumentality than a crane truck in site. one more reason is that associate degree excavator is far convenient and that they will perform the traditional creating by removal and lifting tasks furthermore because the suspension works mentioned higher than.

VARIETIES OF CRANE HOOKS

There's many varieties of hooks square measure offered in rising market supported their specific demand a number of them square measure mentioned bellow

1 Laminated hook	2 Overhead cranes hook	3 Gantry crane hook	4 Mobile crane hook
5 Tower crane hook	6 Single and double crank hook	7 Forging hook	8 Electric rotary hook

II LITERATURE REVIEW

Mr. A. Gopichandet. al(2013)[1] worked on "Optimization of style parameters for crank hook mistreatment Thaghchimethod".In this paper he all over that CI crank hook with Triangular cross section has having minimum von-misses stress comparison to alternative cross sections of crank hook for similar dimension. For the improvement of style parameters he used Taguchi methodology. at first the crank was shapely in PRO/E code Mr.M.Shaban [3] have done Stress distribution in Crane Hook by mistreatment Caustic methodology .The complete study is associate degree initiative to determine a FEA procedure. Model was ready in ABAQUS code. consistent with his methodology for reducing the failures of hooks the estimation of stresses, their magnitudes and attainable locations area unit important. From this stress analysis we've discovered the cross section of Georgia home boy stress space. If the world on the inner facet of the hook at the portion of Georgia home boy stress is augmented then the stresses can get reduced. He projected caustic methodology is extremely powerful methodology to notice the strain distribution for classy mechanical parts like hooks. Mr.PatelRavin B et. al [9]In this paper hook is meant analytically for the various materials like cast steel and high tensile steel. at the moment style and modeling of hook is completed in modeling soft-ware (solid edge).The modeling is completed by mistreatment the planning calculation from the model analysis of hook is completed in FEA code (ANSYS). From this paper we tend to discovered cast steel obtaining minimum stress underneath the masses.

Yu Hualiet. al (2009),[11] this paper centered on the structure-strength. that is that the key index to response the supporting ability of the elevating instrumentation (crank hook). Researching & analyzing the static characteristic of the hook that functions at the restricted load has a crucial aiming to style larger tariff hook precisely. during this study, hook of drill well DG450 were analyzed. at first supported the characteristic modeling technology and also the 3-D entity model of the hook designed in Pro/E. at the moment the static analysis on 3 dangerous work conditions at final load of hook was developed by FEM code ANSYS. This work represents the educational which means and engineering application price to the planning and development of the larger tariff drill well hook. Apeksha K Patel.et al. [13] has worked on reduction of weight of hook that has reduced the price of hook and conjointly will increase lifetime of hook. They ready a mathematical style for crane part by victimization ANSYS work bench V12 code and conjointly optimized hook by victimization tetragon cross sectional space. Bhupender Singh et al (2011), [15]in this Work conferred involves the solid modeling and finite part analysis of crane boom. that has been done victimization PRO/E inferno a pair of.0 and Altair HYPER MESH with OPTISTRUCT eight.0 problem solver Software? The variation of stress & displacement within the varied elements of the Crane boom and attainable actions ar taken to avoid the high stress level and displacement. By victimization FEA the subsequent objectives are achieved. Weight Reduction as four.86 kg, Stresses ar among limits (at higher load points).value cutting(Rs-180/- for one component). The analysis conjointly over that most stress is reached.

Mr.C. Oktay Azeloglu.et al. [18] has worked on the tactic for the calculation of stress supported the various assumption. at first this methodology is approximate calculation methodology, during this methodology curvature of the hook is neglected and calculations area unit thought-about supported a straight beam. He adopted Timoshenko"sincurvate theory and Bach approximation for the easy hooks calculation. Finally he chooses finite component methodology to estimate the strain and compared it with completely different methodology.

III CAUSES OF FAILURE OF CRANE HOOK

The most reason for failure in any element is stress concentration in this specific. Once plying load on element it subjected to fret concentration and deformation. If the elicited stress of the element is among the elastic limit of the element material it doesn't undergoes any deformation. If the elicited stress within the element exceeds the elastic limit of the element material. The deformation of the fabric starts slowly and cracks are propagates within the material, that ends up in fracture the element.These causes Bending stresses combined with tensile stresses, weakening of element thanks to wear, plastic deformation thanks to overloading and excessive thermal stresses are a number of the opposite reasons for failure.

The formation of fractures primarily 2 sorts supported cracks propagation within the material. These are

Ductile fracture:

The ductile fracture is principally happens in ductile material. Once continuous loading and unloading of ductile element stresses ar elicited in it .if the elicited stress exceeds the permissible worth that causes cracks within the element. The cracks propagation is slowly fashioned and that leads fracture the element once reaching the yield strength of fabric. Therefore here propagation of cracks are simply detectable and there's an opportunity to forestall the fracture and replace the element.

Brittle fracture:

Brittle fracture is principally happens in brittle material. Once continuous loading and unloading of brittle element stresses are elicited in it .if the elicited stress exceeds the permissible worth that causes cracks within the element. The cracks propagation is suddenly fashioned and that leads fracture the element once reaching the final word strength of fabric. So here propagation of cracks are terribly tough observe and there's no probability to forestall the fracture and replace the element.

Theories of failure

A mechanical part fails as a result of the applied stresses exceed the material’s strength. beneath any load combination, there's invariably a mixture of traditional stresses induced in this part. Because of the induced stress there's fracture in some parts yielding may also be thought-about as failure, if yielding distorts the part in such the simplest way that it not functions properly. To finding the explanations for failure of crane hook vital and what styles of stresses area unit leads the failure of hook ought to be studied by some failure theories .There area unit 5 theories area unit projected by completely different authors to estimate the utmost limiting stress worth for the part according their theories.

Styles of failure theories:

Most principal stress theory(Rankine’sthory)
Most principal strain theory(St. Venant’s theory)
Most shear stress theory(Guest and tresca’s theory)
Most strain energy theory(Haigh’s theory)
Most shear strain energy theory(Von-misses and hencky’s theory)

MATERIAL ASSIGNMENT

In engineering application the choice of materials plays a really impotent role. thanks to every and each tiny part works beneath completely different atmosphere, conditions and applications. because of this reason the choice of fabric for part is incredibly vital. Crane hooks area unit worked beneath significant load conditions in engineering application, in grips that abundant of load the Crane hooks area unit to be designed by terribly robust materials. Therefore the materials ought to be isotropic in nature and since of it will elongate linearly per stress-strain relation. In our project we have a tendency to choose some alloy materials supported their properties to research the Crane hook part by applying constant load , beneath constant pure mathematics of the hook, finally proposing the fabric supported von-mises stress, deformation . Alloy material having low carbon content, and high strength for coming up with a crane hook as a result of skillfulness of characteristics.

The following steel materials area unit considering in this project.

AISI4150 - formed steel At tempered condition. ASTM A 148 - steel At tempered condition.

AISI1340 - metal steel At tempered condition

IV UNIGRAPHICS

Prologue to NX (Engineering) rapidly spreading fire 10.0 is ground-breaking programming used to make complex plans with extraordinary exactness. The structure goal of any three-dimensional (3D) model or get together is characterized by its detail and its utilization. You can utilize the intense apparatuses of NX-Engineer to catch the structure expectation of any mind boggling model by joining knowledge into the plan. When you comprehend the element based, acquainted, and parametric nature of NX-Engineer is intensity of a strong modeler. The Parametric innovation corporation(PTC) is perceived as a vital accomplice which can push a producer to the transform a procedure into focused development, more prominent piece of the overall industry higher benefits or modern and mechanical structure to utilitarian reenactment assembling and data administration. It is mechanical plan arrangement will be enhanced structure efficiency. Notwithstanding demonstrating standard geometry parts, it enables the client to plan complex free frame shapes, for example, airfoils and manifolds. It additionally combines strong and surface displaying methods into one ground-breaking apparatus set. The product has great mixture displaying capacities by incorporating imperative based element demonstrating and express geometric displaying. NX is the world's developing provider of planning programming, particularly proposed to help a completely coordinated item advancement process."Parametric" implies that the physical state of the part as get together is driven by the valve relegated to the characteristics of its highlights.

Configuration apparatuses which were utilized in this product are most prudent in power, adaptability and efficiency. Which offers specialists to work quicker and most adequately in the full scope of plan applications, the advancement of item at first begins from 2D outline to 3D demonstrating, and, drafting, at that point after it go's to get together structure and documentation. Work Seamlessly with Data from Other CAD Systems With synchronous innovation, the prudent preferred standpoint of NX is enables us to specifically utilize models which are made with other CAD programming by this we can import and change the CAD programming geometry of work part.

SPECIFICATION OF CRANE HOOK

On the off chance that The snare is consider as bended pillar, as per bended bar hypothesis The pressure circulation design over the bar is checked for its rightness on model of crane snare utilizing Winkler-Bach hypothesis.

Winkler-Bach's formulae Bed distance across of snare is 'D' $D = X\sqrt{P}$

Where P = Application of load in KN

Where X = Constant running between 12 - 14. For monetary structure X ought to be consider as least as could be expected under the circumstances. So we taken X = 12 for monetary structure of snare.

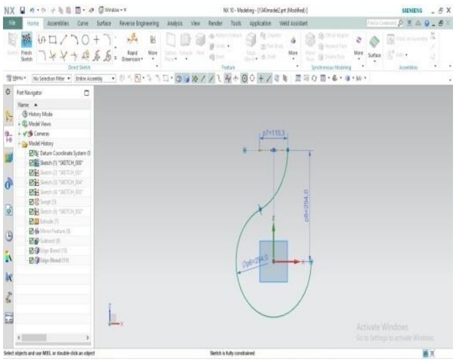
Application stack (P) = 600 KN Cross area of hook Trapezoidal

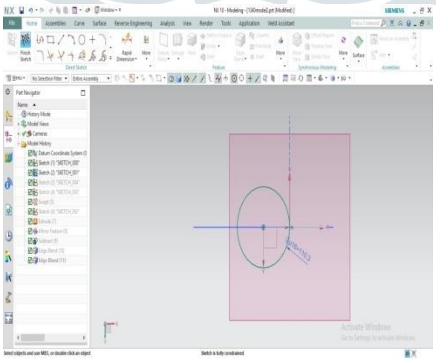
Inward hover distance across of snare (D) = 294 mm Length goodness trapezoidal (H) H = 0.5 D = 147 mm

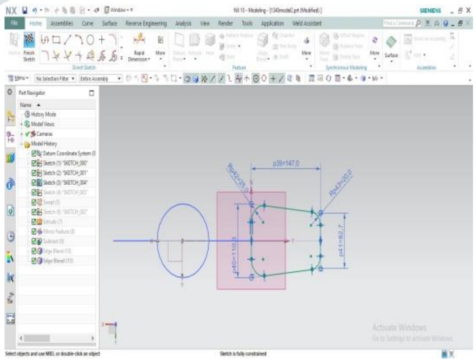
Expansive width of trapezoidal (M) M = 0.75 H = 110.25 mm Little width of trapezoidal (B) B = 0.75 M = 82.6875 mm

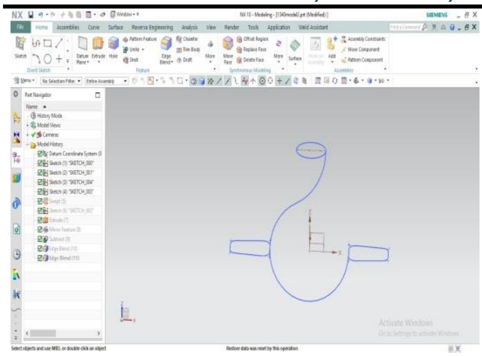
H, M, and B particular are expected for safe structure of the crane snare.

PROCEDURE USED TO DESIGN TRAPEZOIDAL HOOK MODEL

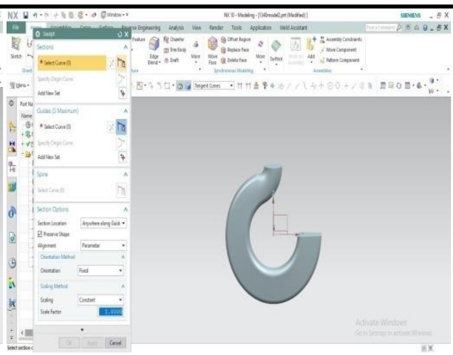

Initial sketch 1


hook head sketch 2

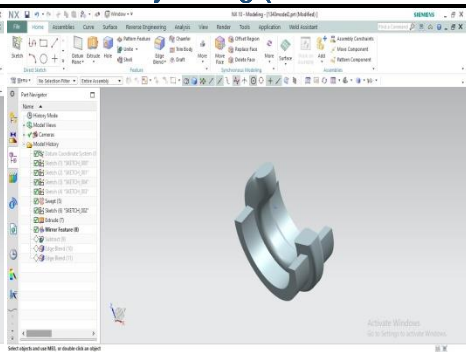

Trapezoidal cross section sketch 3



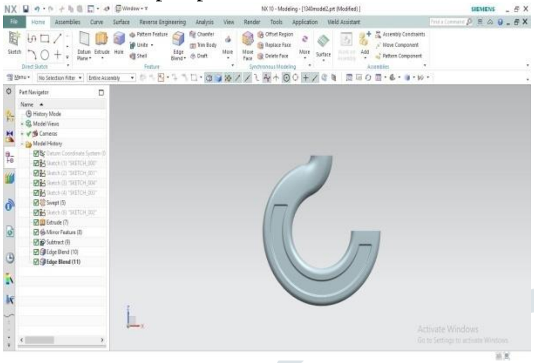
Section of swept option



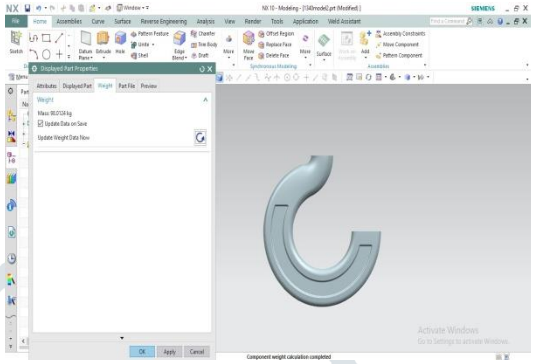
Crane hook model



Removal of material for optimization



Optimized crane hook



Weight checking of hook

V NX-NASTRAN

NASTRAN is basically a solver for limited component examination. Yet, it doesn't have usefulness that takes into account graphically constructing a model or lattice. All info and yield to the program is as content documents. Be that as it may, numerous product sellers advertise pre-and present processors planned on improve building a limited component demonstrate and breaking down the outcomes. These product devices incorporate usefulness to import and streamline the CAD geometry, and work with limited components, and apply burdens and restrictions. NX apparatuses which enable the client to present an investigation to NASTRAN, and import the outcomes and show them graphically. Notwithstanding pre-and post-handling abilities, we have a few NASTRAN sellers have incorporated further developed nonlinear capacities into their NASTRAN items. NASTRAN programming application was composed to help plan more effective space vehicles, for example, the Space Shuttle. NASTRAN was discharged to the general population in 1971 by NASA's Office of Technology Utilization. The business utilization of NASTRAN has investigated the conduct of versatile structures of any size, shape, or reason. For instance, the car business utilizes the program to configuration front suspension frameworks and controlling linkages. It is likewise utilized in structuring railroad tracks and autos, spans, control plants, high rises, and flying machine. NASTRAN was drafted into the U.S. Space Foundation's Space Technology Hall of Fame in 1988, one of the main advancements to get this renowned respect.

GENERALIZED PROCEDURE FOR FEA

Pre-processing Solution Post-processing

PRE-PROCESSING

The examiner builds up a limited component work to separate the subject geometry into sub spaces for numerical investigation, and applies material properties and limit conditions. The preprocessing step is, by and large, depicted as characterizing the model and incorporates geometric area of the issue. Characterize the component type(s) to be utilized to characterize the material properties of the components. Characterize the geometric properties of the components (length, zone, and the like).Define the component availability's (work the model).Define the physical limitations (limit conditions).Define the loadings.

SOLUTION

Amid which the program infers the administering lattice conditions from the model and unravels for the essential amounts. Amid the arrangement stage, limited component programming amasses the overseeing logarithmic conditions in lattice frame and figures the obscure estimations of the essential field variable(s).

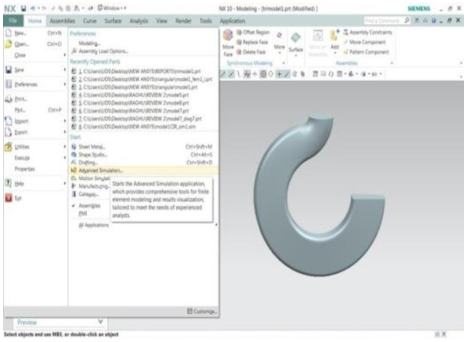
POST-PROCESSING

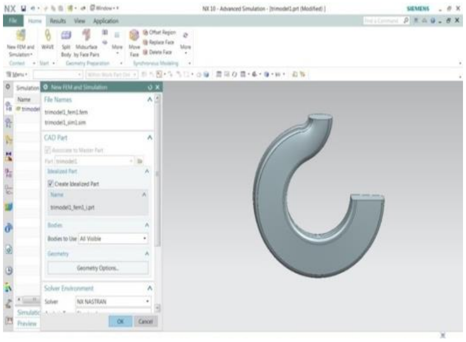
Investigation and assessment of the arrangement results is alluded to as post preparing. Postprocessor programming contains complex schedules utilized for arranging, printing, and plotting chosen results from a limited component arrangement. Models of activities that can be refined incorporate Sort component worries arranged by greatness.

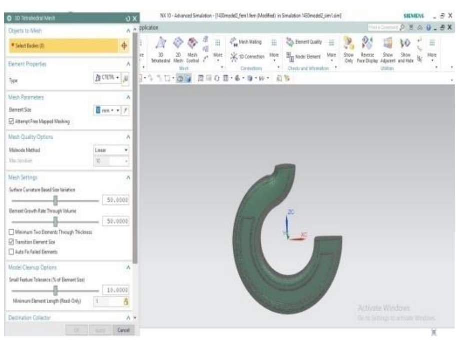
IN OUR PROJECT NX NASTRAN IS USED FOR STRUCTURAL SIMULATION

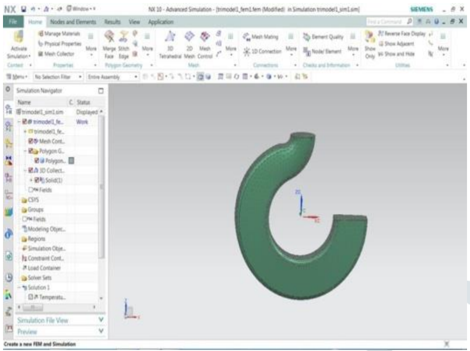
At first we need to ponder how a part or item gathering, responds under the pressure or load vibrations is basic in among any industry, for this the items and materials turn out to be progressively more unpredictable, the architects require devices that go past direct statics investigations. Simcenter incorporates the auxiliary answers for you requirement for an extensive variety of basic investigation issues inside a solitary client condition. Team to this there is never again require one device for direct statics, another to think about weakness, but then another for nonlinear investigation. Thus, building divisions can merge examination devices, and you just need to know a solitary UI. Direct examination is utilized to take care of static issues, for example, deciding whether a structure will flop under a recommended load, and can likewise be utilized to take care of transient issues where loads change after some time. Simcenter highlights an entire scope of coordinated straight examination usefulness, including investigation for direct statics, ordinary modes and clasping.

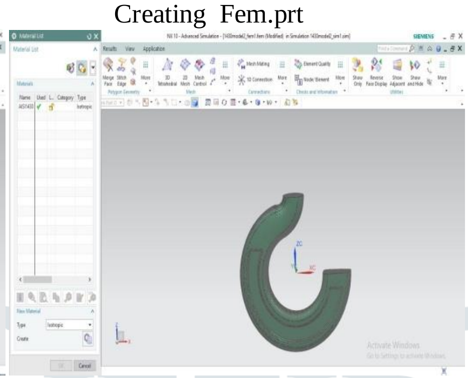
ADVANCED SIMULATION PROCEDURE

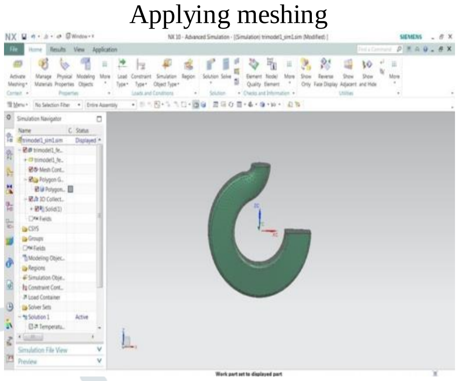

Advanced simulation window

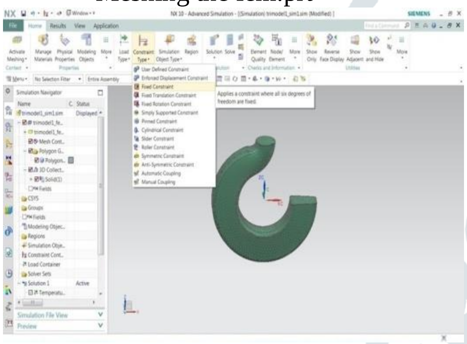

Creating Fem.prt

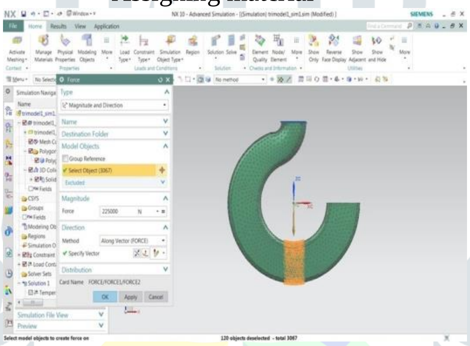

Applying meshing

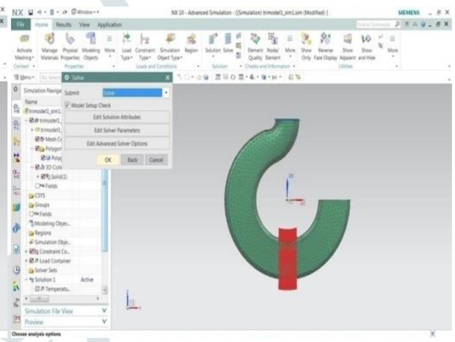

Meshing the fem.prt

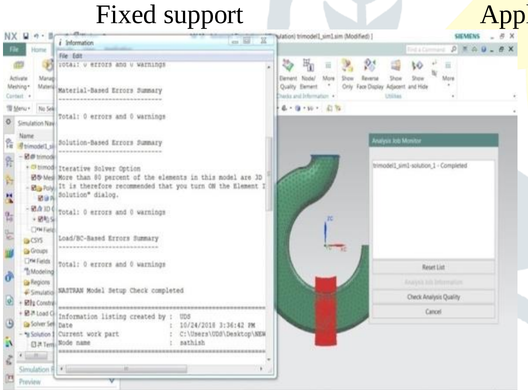

Assigning material

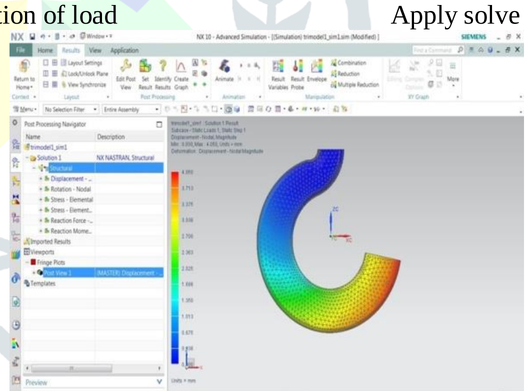

Simulation window


Fixed support


Application of load


Apply solve


Analysis job mode


Structural result window

The Advanced reenactment technique can be done by thinking about after Static Analysis, Nature of Material property and Material Models, Nature of the material like Linear Elastic Isotropic, and Plotting Results got in examination to create an outcome plot and result instruments. Posting Results, lastly Overview of the outcomes which got in ansys that can be recorded,

After that Results are appeared in charts and examined about how to getting the outcomes, the outcomes depend on Structural Studies, At last posting the fundamentals of checking the pressure results and distinctive materials utilized in the checking methodology.

Same procure is rated for optimized crane hook and comparing crane hook before and after removal of material and plating the results for both crane hooks and finally choosing which material is better for safe designing of crake hook with or with out optimization of material.

5.9 MESH

One of the principle apparatus in the examination module which are utilized to break down the part is MESH. Cross section which isolates the perplexing geometry of the part into equivalent number of little components to tackling the issue which are available in the crane snare and this is the principle distinction between numerical strategies and Finite component investigation. In this venture we have done tetrahedral direct work with basic size as 10

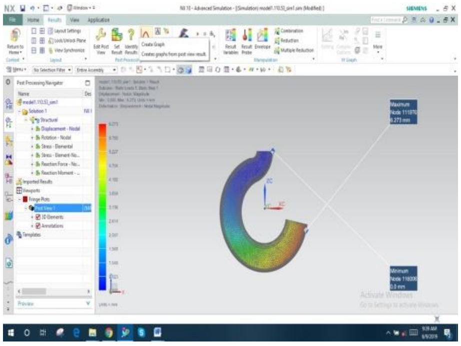
VI EXAMINATION OF TRAPEZOIDAL HOOK ON VARIOUS ALLOY STEELS

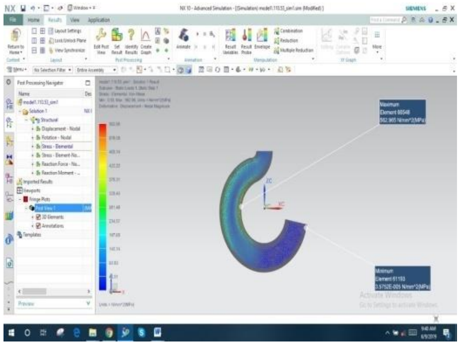
ANALYSIS OF TRAPEZOIDAL CRANEHOOK BY AISI 4150

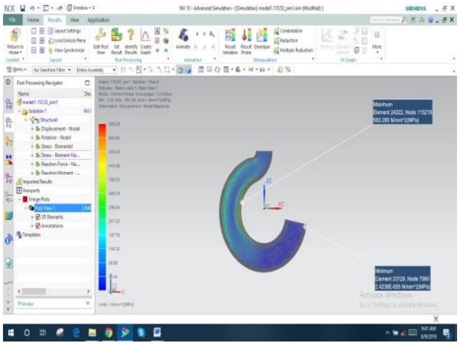
Properties of AISI4150

Density : 7850 kg/m3 Young's modules of flexibility: 210 Gpa Poisson ratio : 0.30
Shear modules of flexibility: 80 Gpa Elastic strength : 731 Mpa Yield strength : 380 Mpa

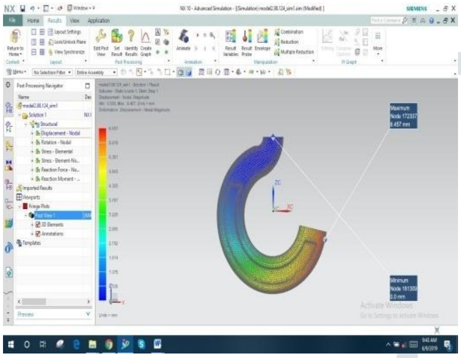
ANALYSIS RESULTS OF AISI4150 BEFORE OPTIMIZATION


Displacement


Yield stress


Tensile stress

ANALYSIS RESULTS OF AISI4150 AFTER OPTIMIZATION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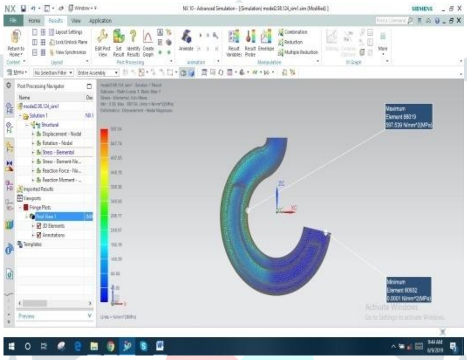
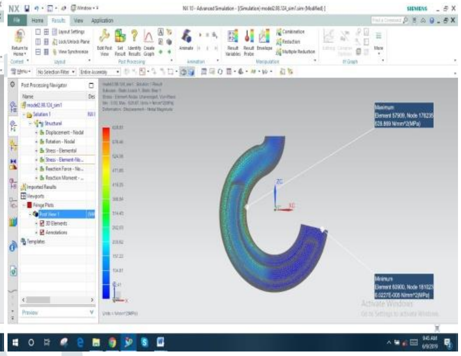

Yield stress


Tensile stress

TABULATED ANALYSIS RESULTS OF AISI4150

Load 600KN	Values	Von-mises Yield Stress in N/mm^2(Mpa)	Von-mises Tensile Stress in N/mm^2(Mpa)	Deformation in mm
Before Optimization	Maximum at Node	562.96 At 66548	593.285 At 24222	6.273 At 111976
	Minimum at Node	3.57521E-005 At 61193	2.4238E-005 At 33729	0.00 At 116006
After Optimization	Maximum at Node	597.539 At 88019	628.869 At 176235	6.457 At 172337
	Minimum at Node	0.0001 At 60932	6.0227E-005 At 60900	0.00 At 181309

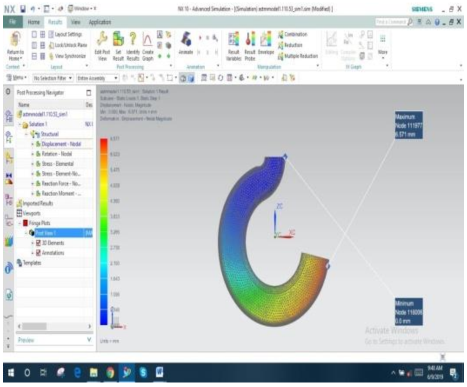
Table 1

ANALYSIS OF TRAPEZOIDAL CRANEHOOK BEFORE ASTM A 148

Properties of ASTM A 148

Density : 7800 kg/m^3 Young's modules of elasticity : 190 Gpa Poisson ratio : 0.29
Shear modules of elasticity : 73 Gpa Tensile strength : 710 Mpa Yield strength : 460 Mpa

ANALYSIS RESULTS OF ASTM A 148 BEFORE OPTIMIZATION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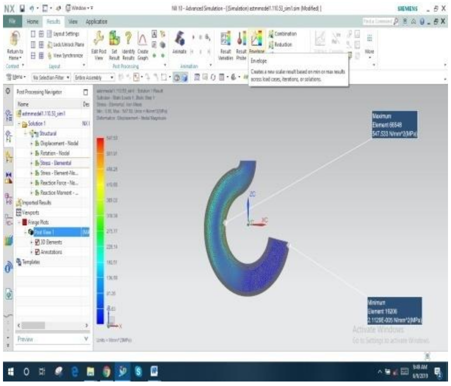
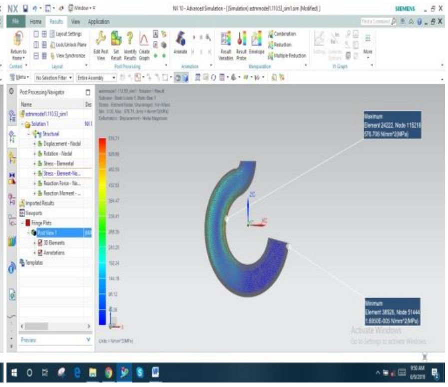
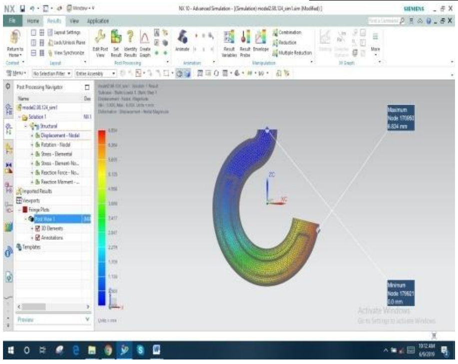

Yield stress


Tensile stress

ANALYSIS RESULTS OF ASTM A 148 AFTER OPTIMIZATION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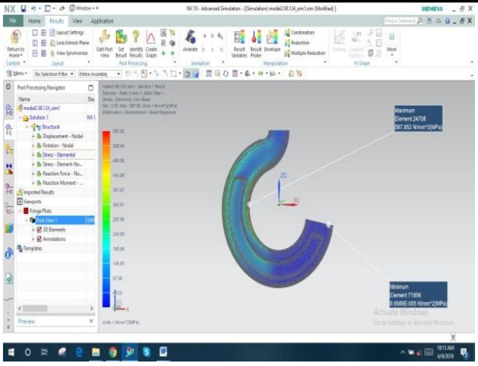
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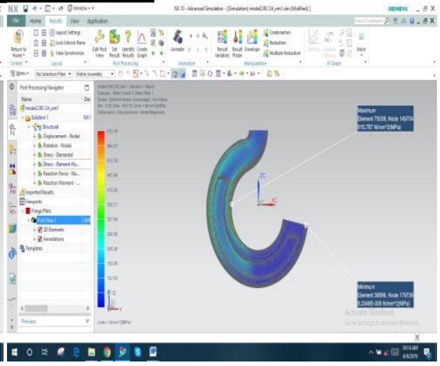

Tensile stress

TABULATED ANALYSIS RESULTS

Load 600 KN	Values	Von-mises Yield Stress in N/mm^2(Mpa)	Von-mises Tensile Stress in N/mm^2(Mpa)	Deformation in mm
Before Optimization	Maximum at Node	547.533 At 66548	576.706 At 24222	6.571 At 111977
	Minimum at Node	2.1129E-005 At 19206	1.6950E-005 At 38528	0.00 At 116006
After Optimization	Maximum at Node	587.952 At 24708	615.787 At 75039	6.834 At 170950
	Minimum at Node	8.9569E-005 At 71806	8.2348E-005 At 36896	0.00 At 35424

Table 2

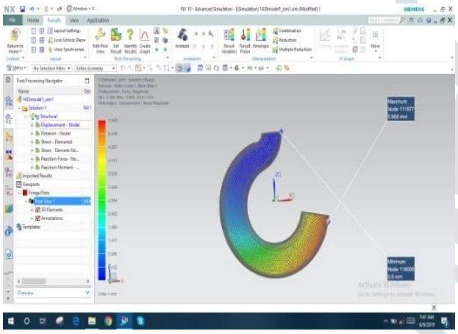
ANALYSIS OF TRAPEZOIDAL CRANE HOOK BYAISI1340

Properties of AISI1340

Density : 7870 kg/m^3 Poisson ratio : 0.30 Young's modules of elasticity : 210 Gpa

Tensile strength : 703 Mpa Yield strength : 434 Mpa Shear modules of elasticity : 80 Gpa

ANALYSIS RESULTS OF AISI1340 BEFORE OPTIMIZATION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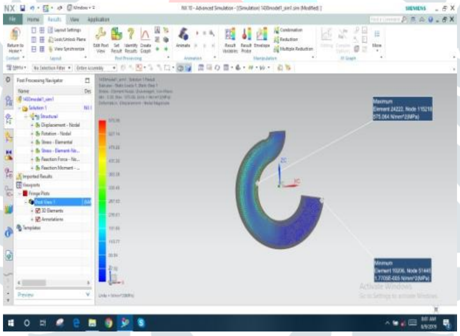
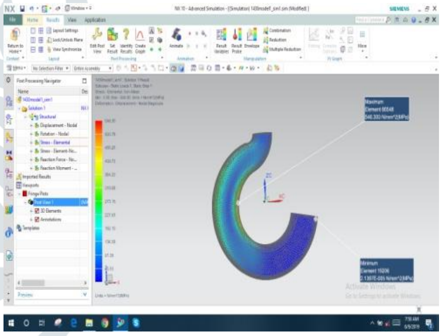
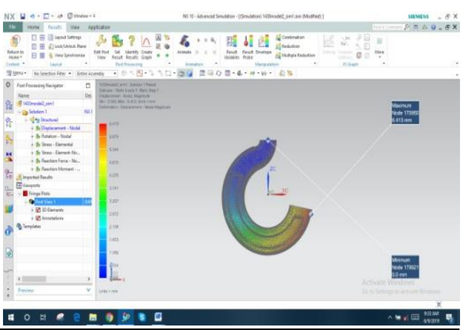
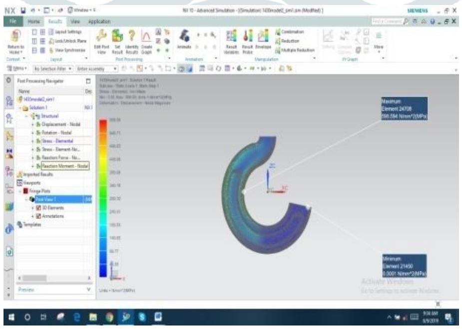
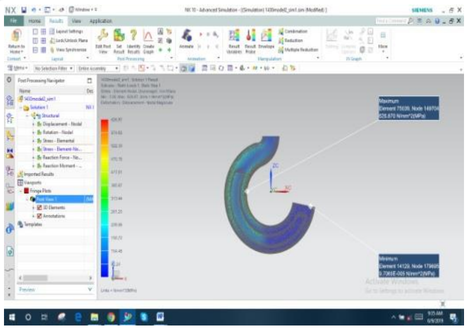

Yield stress


Tensile stress

ANALYSIS RESULTS OF AISI1340 AFTER OPTIMIZATION


Displacement


Yield stress


Tensile stress

TABULATED ANALYSIS RESULTS OF AISI1340

Load 600 KN	Values	Von-mises Yield Stress in N/mm^2(Mpa)	Von-mises Tensile Stress in N/mm^2(Mpa)	Deformation in mm
Before Optimization	Maximum at Node	546.300 At 66548	575.064 At 24222	5.908 At 111977
	Minimum at Node	2.1397E-005 At 19206	1.7705E-005 At 19206	0.00 At 116006
After Optimization	Maximum at Node	598.594 At 24708	626.870 At 149704	6.413 At 170950
	Minimum at Node	0.0001 At 21450	9.7069E-005 At 14129	0.00 At 179921

Table 3

VII RESULTS COMPARISION OF DIFFERENT ALLOY MATERIAL

NAME OF THE MATERIAL	MAXIMUM VON-MISES STRESS in N/mm^2(Mpa) at 600 KN Load				MAXIMUM DEFORMATION in mm	
	Before Optimization		After Optimization		Before Optimization	After Optimization
	Tensile	Yield	Tensile	Yield		
AISI 4150 WROUGHT IRON ALLOY	593.285	562.96	628.869	597.539	6.273	6.457
ASTM A 148 CAST STEEL ALLOY	576.706	547.533	615.787	587.952	**6.571mm**	**6.834**
AISI 1340 MANGANEES STEEL ALLOY	575.064	546.300	626.870	598.594	5.908	6.413

Table 4

CONCLUTION

A structure demonstrate was built to robotize the plan of a Lever-activated Crane hook(snare) for lifting heap of 600 KN .An utilitarian methodology was received to reason about the capacity of a Crane snare and afterward to disintegrate its plan into its capacity, conduct and structure. The number, introduction, situation and measurements of the segments that make up the carne snare and which fulfill the capacities and practices' are registered. The structure of the plan show is rehashed for steady load application on various compound steel materials and consistent geometry of the model, yet holding a similar capacity and conduct, the structure display was executed in the Uni-designs 10.0 framework. The limited component examination (FEA) done by utilizing NX NASTRAN 10.0 framework.

From the investigation of the leaver impelled crane snare we presumed that AISI 1340 Manganees steel alloy compound was subjected to least von-mises ductile worry of 575.064N/mm2(Mpa) and least distortion of 5.908 mm under the heap of 600 KN before optimization and von-mises malleable worry of 626.870 N/mm2(Mpa) and least misshapening of 6.413 mm under the heap of 600 KN among the other amalgam steel which are utilized in this paper.

From the analysis results we concluded that when applying the load 600 KN the hook subjected to least stress which are very nearer to theoretical stress values this causes damage of hook before Material Optimization. But applying 600 KN load the induced stresses in the hook are under the so far the theoretical stress values but most higher stress and deformation after Optimization of Material. So we proposed the modeling hook used in this paper is suitable for loads up to 600 KN.

Stress and deformation induced in the optimized hook also under the theoretical values considering in the modeling of hook so by this we can saved the maximum amount of material. In this thesis we optimized around 12 kg of material from the hook. Which can save the cost of material for single hook.

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