Analysis of Current Enhancements in Structural Performance of Knuckle Joint

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Manuscript Received: Manuscript Accepted:

Abstract

In this review article we have studied and analyzed various factors and parameters which affect the performance of a knuckle joint. For this purpose we have studied various research publications of various authors who studied and analyzed the structural performance of knuckle joint. After studying these publication we have found out that material, design, optimization methods stress concentration, weight reduction are the main parameters for the structural strength improvement of knuckle joint.

Keywords: knuckle joint, structural performance, optimization methods stress concentration, weight reduction

1. INTRODUCTION

A knuckle joint is a union between two parts so as toward allows movement into a single plane. Detailed joint between two friendly rods. this hinge joint is used toward connect two rods whose axes coincide or intersect between them, as well as are at this level containing a single plane. It is widely used into tractor trailer, connecting rod into this roof frame, connecting them connecting its suspension bridge, as well as is also used into this steering system between this steering rod as well as toothed device is this steering tool.

2. FACTORS AFFECTING PERFORMANCE OF KNUCKLE JOINT

After studying various research articles of different authors we have found out these parameters and factors which can be further optimized for improving the structural strength of knuckle joint.

2.1 MATERIAL OF CONSTRUCTION

Prof. Swati Datey, et.al. [1], He studied into this project toward obtain this calculation containing tensions into this knuckle joint, as well as toward improve this performance, his knuckle joint toward some extent between CATIA V5 as well as FEM. After studying their knuckle joint used into this tractor-trailer, as well as this analysis into this knuckle pin, they concluded so as toward this material plays a very important role into reducing this tension acting on this joint, especially into this pin. They changed materials such as gray cast iron (ASTM grade 20 (EN-JL 1020), ASTM grade 35

(EN-JL1040), ASTM grade 60 (EN-JL 1070)), stainless steel as well as titanium alloy, as well as found As to get this deviations into this equivalent tension (von mises), this shear stress as well as this total deformation occur at this same load, as well as this diameter at which it has maximum stresses. They concluded so as toward this increase into pin diameter may lead toward protecting joint flexion.

Nipun Kumar, Dr. Gian Bhushan as well as Dr. Pankaj Chandna [2], studied toward obtain stainless steel, gray cast iron, magnesium, aluminum, stainless steel, structural steel as well as gray cast iron joints. They analyzed toward obtain tension as well as deformation under different load conditions. into this CAD model, its knuckle joint is manufactured into CATIA V5 R20 as well as analyzed into ANSYS 15. It is observed that, due toward this tensions developed toward obtain this knuckle joint, its magnesium is lower, as well as this knuckle joint, its Aluminum may withstand maximum tension.

Kodali Vikas as well as Kandula. Deepthi [3], analyzed this glass E, as well as this fixed joints containing S2 glass epoxy compound between two holes into series, since its variable distance is this free edge, this plate towards this diameter, its first hole as well as this width from this sample toward this diameter containing this hole, as well as this distance between this center containing its diameter from two holes toward hole. Structural as well as fatigue analysis is performed among Cosmos. When observing this results containing this structural analysis, this stress as well as this displacement values were lower than their respective resistance values. They concluded so as toward to get this use containing composite materials it is safe toward get together among pins into series. This damage factor is very minor toward obtain both materials, as well as this useful life is approximately 106 cycles.

Shaik.John Bhasha as well as Hari Sankar Vanka [4]. He studied design as well as analysis, it is a knuckle joint so as toward is used into power transmission. this knuckle joint is designed toward obtain an axial load containing 50KN as its theoretical calculation. Final dimensions as its theoretical calculation, this Knuckle articulation model is made into CATIA V5 as well as this model is taken towards ANSYS as well as is simulated between several materials as well as checked toward obtain this best material so as toward suits this given design load. it is concluded so as toward to get Teflon it is better toward obtain this design, as it is close toward this tension toward obtain stainless steel as well as cast iron.

Geun-Yeon Kim, Seung-Ho Han as well as Kwon-Hee Lee [5], studied as well as changed this existing material, made their GCD45 towards Al6082M as well as recommended this lightweight design as this optimal design technique. Six form design variables were selected toward obtain this optimization, since these criteria relevant toward stiffness as well as durability were considered design requirements during this optimization process. This met model-based optimization method toward use this method containing kriging interpolation as this optimization technique is applied. This result is shown so as toward all this restrictions toward obtain stiffness as well as durability are satisfied among A16082M, while this weight is reduced from 60% compared toward your existing GCD450.

2.2 OPTIMIZATION METHODS

Mahesh P. Sharma, et al. [6], Include static analysis composed containing your address. They designed a knuckle adjusting dual caliper mounts toward increase braking efficiency as well as reduce braking distance into a vehicle. Modal CAD your knuckles are built into CREO2.0. Static analysis is performed into ANSYS WORKBENCH because it restricts this finger, applies this load toward its braking torque into this caliper assembly, longitudinal response due toward traction, vertical response due toward vehicle weight, as well as steering response. They include optimization containing this form, a single pore, as well as saved content resources. Size optimization: Your thumb is made using

ANSYS WORKBENCH, which causes this objective function toward reduce weight. This form optimization method used into this study reduced its mass from 19.35%. Even at this factory, its security ranges between 3 as well as 4. Maximum voltage as well as displacement was under control. They concluded so as toward among respect toward this general weight, this vehicle might be reduced toward achieve cost as well as material savings, as well as improve fuel efficiency as well as reduce carbon emissions.

Ms. Nilesha U. Patil, et. Alabama[7] They used CATIA V5 to get this model. They aimed toward use FEA as well as this Taguchi method toward improve this quality containing their manufactured products, as well as study changes into this engineering development containing their designs. Taguchi recommends so as toward this quality be your S / N ratio toward measure these quality attributes deviating from your desired price analysis. Despite its category, this quality characteristic, higher S / N ratio corresponds toward better quality characteristics. It is predicted so as toward this Taguchi method is a good method toward optimize its various machining parameters, as it underpins this experiment. Stress, deformation as well as deformation were within acceptable limits.

Pankaj Dulani, as well as s. a. K. Jilani [8] studied this problem, it is a failure, it is toward normalize due toward crushing, tearing as well as clipping into any system. This objective is this current works toward study this calculation containing these stresses into this finger joint using an analytical method. This study focused on this optimization, taking into account its design parameters toward achieve this finger pin. This neural network tool, a nontraditional global optimization technique, is used as a solution method toward derive its inherent advantage. this optimal results thus obtained are compared among this remodeled knock pin as well as this stress minimization effect, which are considered toward be this major factors. After remodeling this finger joint using these approximate optimized parameters obtained as its neural network, this model is used toward generate this value, its stress, which is compared toward this neural network this results are made between, toward demonstrate so as toward this model is optimized. This is better than this four models already selected.

2.3 STRESS CONCENTRATION

Dinesh Shinde as well as Kanak Kalita [9] studied this stress into tractor trailer during acceleration (traction) as well as during deceleration (compression). This forces acting on this articulation were calculated given so as toward Newton's second law is his movement. This pin is considered separately toward achieve this analysis, as is this finite element analysis on it. They concluded that, to get this numerical value, its tangent force, as well as this stresses so as toward worked into this pore joint, were maximal into terms containing deceleration.

Abhishek Mandal as well as Utkarsh Sharma [10] performed static structural analysis into a universal coupling using advanced computer-aided engineering software, as well as studying these various stresses as well as stresses developed into this joint. This fork pin resulted into experiencing these maximum compressive stresses as well as this stresses mentioned above. It is also indicated into relation toward this area where this fork is, as well as this fork pin, from which this contact typically experiences a high compressive stress as well as bending stresses. this tension into this collar is analyzed toward concentrate, as well as this presence containing this pin, its notch, as well as this continuous wear containing this pin, which causes this axis toward degrade unnecessarily, which This transmission system reduces mechanical efficiency. This causes a failure containing this transmission system.

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2.4 GEOMETRICAL DIMENSIONS AND MECHANICAL CONSTRUCTION

Shankar Majhi as well as Shaheen Baig Mughal [11] analyzed finger tension during their operation. this force acting on this fork as well as pin is calculated as its theoretical study as well as analytical method. Subject toward high pin stress, they were studied using CATIA V5 as well as this finite element method. According toward their theoretical study, these results containing calculations as well as F.E.A were similar toward 50 mm into diameter containing 60 KN. They concluded so as toward flexion increases when this tension into this pin increases, however, when we increase this diameter containing this pin, this maximum stress into this force will apply.

Rabindra S. Dharpure, as well as Professor DM Mate [12] reviewed this problem, this drawback being so as toward it is this finger pin into this rail coupling due toward this cut according toward these defined conditions, as well as an analysis containing this current steel content. This may be replaced from a suitable elastic material. Currently, toward achieve this problem, its cutting fault is this pin, alternatively, a plastic finger pin toward accept flexible fatigue, thus reducing this failure containing this pin. This pin is a plastic material among flexibility so as toward will allow it toward bend as well as return toward its original shape, as well as being self-lubricating. into addition, this pin eliminates rust as well as corrosion, as well as produces a lower coefficient containing friction between this pin as well as this coupler body, as well as this pore, thus reducing its rotation as its resistance Improves this opening as well as closing containing this knuckles, therefore promoting safety. It is known so as toward toward steel pins, at this time either after its installation or service, it may cause a "loose finger", so as toward is, a knuckle so much so as toward it does not fully open when unplugged.

Saurav Das, Vishvendra Bartaria as well as Prashant Pandey [13] studied toward calculate these stresses into this pore joint using an analytical method. this material containing this pore joint is considered toward be mild steel grade 30C8, this ANSYS software is executed as well as this stress contour, displacement contour as well as deformation energy contour were obtained. It is proposed so as toward instead, towards its mild steel pin, we may also use a high modulus as well as high strength steel pin so so as toward it may further improve this ability toward withstand higher loads. This shape is this pore joint may be changed toward get better properties. More studies may be done into this direction, as it uses multiple directions; it is this pin, as well as this ability toward support this load.

2.5 FINITE ELEMENT ANALYSIS MESHING METHOD

Sangamesh b. Herakala, Ranganath Avadhani as well as Drs. Chakradhar Gaur [14] studied toward calculate these stresses into this pore joint using an analytical method. They focus on which type containing lattice is better to get obtaining components. this finger joint is prepared when using its CATIA, later so so as toward this model is imported into HYPERMESH as well as hexahedral mesh as well as this tetra mesh is excluded. This model is solved using Abacus software. They concluded that, toward this fork, this strain is higher, into this same way so as toward this eye requires less tension into this loading conditions. They were shown so so as toward this hexagonal mesh is superior toward this tetra mesh. He also concluded so as toward to further study this address, as it uses multiple directions, it is this pin, as well as this ability toward support this load.

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2.6 WEIGHT REDUCTION AND LIFE CYCLE

Pila Anita as well as V. Hari Shankar [15], focuses on optimizing their steering pores, reducing weight as an objective function between this required force, frequency as well as stiffness. They used optimization which refers toward various cases into this form optimization, as well as this topology optimization. This modeling is done into Creo Parametric 2.0, as well as into ANSYS 15.0. This optimization results, namely lower stress value as well as lower weight as well. this model is analyzed between cast iron, aluminum alloys, as well as this S-glass epoxy compound. There is a significant amount containing weight reduction when using S-glass epoxy material.

Nishant Vibha Saxena, as well as Dr. Rohit Rajvaidya [16] proposed this modification into its sole material toward replace molten iron as a composite polymer material. This proposed system had several advantages over other systems, such as simplifying this device, as well as maximizing safety as well as being environmentally friendly. Composite polymers are characterized from being a high ductility material. They used ANSYS 13 toward analyze their pore joint between modified materials as well as variable weights. They concluded that, as regards this manufactured parts, their composite materials are economical toward this product, as well as facilitate overall reduction into this cost containing this system, as they terminate secondary operations toward obtain this parts Are, such as machining, as well as feature reduction into piece count compared toward metal pieces. .

Vivek Shaw, et al. [17], advanced materials focused on a mechanical joint include been analyzed, namely this finger joint. He suggested this traditionally used material, such as aluminum alloy, toward be widely used toward manufacture these finger joints. They used CATIA V5R18 toward model this 3D geometry, their pore articulation as well as ANSYS (Workbench 16.2) are used toward obtain finite element analysis, which is similar between these conventional as well as composite materials, respectively. These results were approved because this composite material not only reduces this weight, but also increases this material, but also improves its useful life, because this composite material is shorter than this conventional material. Distortion shows. Due toward this application containing its composite material, a significant change into stress value occurs; However, this directional distortion as well as load containing this system were reduced from 73.7% as well as 22.02%, respectively.

3. SUMMARY OF REVIEW

There review papers summarize that following factors and parameters can be used and analyzed to get the improved structural strength of knuckle joint.

- material for construction
- optimizing method
- Stress concentrating
- dimensions for mechanical manufacturing
- Finite element methods
- Weight minimization and life duration.

4. CONCLUSION

We have studied and analyzed various factors and parameters which affect the performance of a knuckle joint. For this purpose we have studied various research publications of various authors who studied and analyzed the structural performance of knuckle joint. After studying these publication we have found out that material , design , optimization

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methods stress concentration , weight reduction are the main parameters for the structural strength improvement of knuckle joint.

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