

₹ 200

ISSN - 2249-555X

Volume : 1

Issue : 10

July 2012



Journal for All Subjects

www.ijar.in

Listed in International ISSN Directory, Paris.



ISSN - 2249-555X

Indian Journal of Applied Research

Journal for All Subjects

Editor-In-Chief

Dr A Kumar

Director, College Development Council (CDC)
Director, Internal Quality Assurance Cell (IQAC)
Professor in Management,
Department of Business Administration, Faculty of Management,
Bhavnagar University,

Editorial Advisory Board

Dr. S. N. Pathan
Maharashtra

Dr. SM. Ramasamy
Gandhigram

Dr. M. M. Goel
Kurukshetra

Dr. S. Ramesh
Tamil Nadu

Dr Ramesh Kumar Miryala
Nalgonda.

Dr. B. Rajasekaran
Tirunelveli

Dr. A. R. Saravankumar
Tamilnadu

Dr. Roy M. Thomas
Cochin

Dr. G. Selvakumar
Salem

Dr. Apurba Ratan Ghosh
Burdwan

Dr. Shrawan K Sharma
Uttarakhand

Dr. Sudhanshu Joshi
Uttarakhand

Prof. (Dr.) B Anandampilai
Pudhukottai

Advertisement Details

| Position | B/W (Single Color) | Fore Color |
|--------------------|-----------------------|------------|
| Full Inside Cover | ₹ 6000 | ₹ 12500 |
| Full Page (Inside) | ₹ 5000 | - |

Subscription Details

| Period | Rate | Discount | Amount Payable |
|------------------------|---------|----------|----------------|
| One Year (12 Issues) | ₹ 2400 | Nil | ₹ 2400 |
| Two Year (24 issues) | ₹ 4800 | ₹ 200 | ₹ 4600 |
| Three Year (36 issues) | ₹ 7200 | ₹ 300 | ₹ 6900 |
| Five Year (60 issues) | ₹ 12000 | ₹ 600 | ₹ 11400 |

You can download the Advertisement / Subscription Form from website www.ijar.in. You will require to print the form. Please fill the form completely and send it to the **Editor, INDIAN JOURNAL OF APPLIED RESEARCH** along with the payment in the form of Demand Draft/Cheque at Par drawn in favour of **INDIAN JOURNAL OF APPLIED RESEARCH** payable at Ahmedabad.

1. Thoughts, language vision and example in published research paper are entirely of author of research paper. It is not necessary that both editor and editorial board are satisfied by the research paper. The responsibility of the matter of research paper/article is entirely of author.
2. Editing of the Indian Journal of Applied Research is processed without any remittance. The selection and publication is done after recommendations of atleast two subject expert referees.
3. In any condition if any National/International University denies accepting the research paper published in IJAR, then it is not the responsibility of Editor, Publisher and Management.
4. Only the first author is entitle to receive the copies of all co-authors
5. Before re-use of published research paper in any manner, it is compulsory to take written permission from the Editor-IJAR, unless it will be assumed as disobedience of copyright rules.
5. All the legal undertaking related to Indian Journal of Applied Research is subject to Ahmedabad Jurisdiction.
7. The research journal will be send by normal post. If the journal is not received by the author of research papers then it will not be the responsibility of the Editor and publisher. The amount for registered post should be borne by author of the research paper in case of second copy of the journal.

Editor,

Indian Journal Of Applied Research

8-A, Banans, Opp. SLU Girls College, New Congres Bhavan, Paldi,
Ahmedabad-380006, Gujarat, INDIA

Contact.: +91-9824097643 E-mail : editor@ijar.in

INDEX

| Sr. No. | Title | Author | Subject | Page No. |
|---------|---|--|-------------|----------|
| 1 | Antioxidant activity of opuntia stricta | S. Jasmine Mary, Dr. A .John Merina | Chemistry | 1-3 |
| 2 | Consumers Perception and Attitude Towards Consumerism | Dr. M. Dhanabhakyaam, M. Kavitha | Commerce | 4-6 |
| 3 | Foreign Direct Investment In India & Indian Economy | Dr. M. K. Maru | Commerce | 7-8 |
| 4 | Service Marketing: An Imperative Ideology for Attracting Customers | Dr. Vipul Chalotra | Commerce | 9-10 |
| 5 | “An Evaluation of Human Resource Accounting Disclosure Practices in Indian Companies” | Dr. Nidhi Sharma Hitendra Shukla | Commerce | 11-13 |
| 6 | Changing Products of Life Insurance Corporation of India After Liberalization-an Overview | Dr. Niranjan Kakati | Commerce | 14-16 |
| 7 | Consumer Behaviour And Marketing Actions | Dr.A.Jayakumar K.Kalaiselvi | Commerce | 17-19 |
| 8 | Corporate Social Responsibility & Ethics in Marketing | Manojkumar Mohanbhai Parmar | Commerce | 20-22 |
| 9 | Regulated Market – an Overview | S. Ravi Dr.K.Uthaiyasuriyan | Commerce | 23-25 |
| 10 | A Socio-Economic And Statutory Approach Towards Right To Life | Manish Parshuram Pawar Dr. Ashok Pawar | Economics | 26-27 |
| 11 | An Analysis of the Impact of Power Sector Reforms in Haryana on the Generation, Transmission and Distribution | Dr. Pardeep S. Chauhan | Economics | 28-30 |
| 12 | Professional Education And Employment Of Banjara and Dhangar Community in India | Dr.Pawar Ashok S Naik Priti A. Dr. Rathod Sunita J. | Economics | 31-33 |
| 13 | Educational condition of Banjara and Vanjari Communities in India: An Over view | Dr.Pawar Ashok S. Tidke Atish S. Dr. Ambhore Shankar B. | Economics | 34-36 |
| 14 | Socio-economic Conditions of Tea Plantation Workers in Bangladesh: A Case Study on Sreemongal | Shapan Chandra Majumder Sanjay Chandra Roy | Economics | 37-40 |
| 15 | The impact of Yoga on Anxiety of Secondary School Students | Dr. D. Hassan | Education | 41-45 |
| 16 | Portfolio Writing: An innovative reflective learning strategy in Teacher Education | Dr.K.Chellamani | Education | 46-48 |
| 17 | Instrumentation system for amperometric biosensor | Chethan .G, Saurav Pratap Singh, Dr. Padmaja .K.V, Dr. Prasanna kumar .S.C. | Engineering | 49-51 |
| 18 | “Performance Analysis of WiMAX Physical Layer Using Different Code Rates & Modulation Schemes” | Harish Prajapati Mrs. B.Harita Mr. Rajinder Bhatia | Engineering | 52-55 |
| 19 | Design Dual-Axis Solar Tracker using Microcontroller | Jigesh R. Shah V. S. Jadhav | Engineering | 56-57 |
| 20 | BER Performance of DS-CDMA System Over a Communication Channel | Rahul Parulkar Rupesh Dubey Angeeta Hirwe Prabhat Pandey | Engineering | 58-60 |

| | | | | |
|----|--|---|-------------|---------|
| 21 | Effect of Strain Hardening Rate on The Clamp Load Loss Due to an Externally Applied Separating Force In Bolted Joints | Ravi Sekhar V.S.Jadhav | Engineering | 61-63 |
| 22 | Advances In Derivative Free Mobile Robot Position Determination | Swapnil Saurav | Engineering | 64-66 |
| 23 | Mechanical Behavior of A Orthodontic Retraction Loop : A Analytical And Experimental Study | Swati Gunjal V.S.Jadhav | Engineering | 67-69 |
| 24 | Enhancement of Surface Finish and Surface Hardness of Burnishing Process Using Taguchi Method | V. N. Deshmukh S. S. Kadam | Engineering | 70-72 |
| 25 | Design & Structural Analysis of an Automobile Independent Suspensions type Mac-Pherson Shock Absorber | Vandana Y. Gajjar, Nihit Soni, Chauhan Sagar, Shaikh EzazAhmed, Surti Pratik | Engineering | 73-80 |
| 26 | A survey on secure file synchronization in distributed system | Chhaya Nayak Deepak Tomar | Engineering | 81-82 |
| 27 | Design of Road Side Drainage | Mehul I. Patel Prof. N.G.Raval | Engineering | 83-85 |
| 28 | Study on Relation Between CBR Value of Subgrade Soil and Moisture Content | Mehul I. Patel Prof. N.G.Raval | Engineering | 86-87 |
| 29 | Design and Optimatization, Weight Reduction of Rear Axle Banjo Housing for Light Weight Vechicle. | S Surya Narayana | Engineering | 88-90 |
| 30 | Product-Mix Strategy of Jammu and Kashmir Co-operatives Supply and Marketing Federation Limited in Jammu District of J&K State | TARSEM LAL | Engineering | 91-93 |
| 31 | Micro Finance: A Study of Semi Urban Women Workers | Soheli Ghose | Finance | 94-98 |
| 32 | "Real Estate Investment Trusts (REITs): An overview of Structure & Legislative Framework" | Mr. Rohit Arora | Finance | 99-101 |
| 33 | Title: "Real Estate Investment Trusts (REITs): Development in India" | Mr. Rohit Arora | Finance | 102-103 |
| 34 | An Assessment of Relationship between Crop Production and Climatic Elements: A Case Study of Karveer Tehsil | Mr. Prashant Tanaji Patil Miss. Mugade Nisha Ramchandra, Miss. Mane madhuri maruti | Geography | 104-107 |
| 35 | Measuring The Performance Of Hypothetical Ltd. Using Z-Score Model | Dr. Prameela S. Shetty Dr.Devaraj K | Management | 108-110 |
| 36 | A Study on Factors Affecting Buying Decision of Garments in Surat City | Dr. Hormaz Dali Patel Dr. Mehul P. Desai. | Management | 111-115 |
| 37 | Hutchinson Essar - Vodafone – A Case Study | Vukka Narendhra | Management | 116-118 |
| 38 | To Study The Effect of Basement with Retaining Walls and The Behavior of The Structure | Patel Shailesh Prof. P. G. Patel | Management | 119-121 |
| 39 | AIDA model of Advertising Strategy | Prof.Arvind Rathod | Management | 122-125 |
| 40 | "A Balanced Corporate Responsibility" | Simon Jacob C | Management | 126-127 |
| 41 | Study and analysis Trend and Progress of Banking in India | Triveni Singh, Prof. (Dr) Sanjeev Bansal, Dr. Amit Kumar Pandey | Management | 128-131 |
| 42 | "Marketing Communication-an Inevitable Part of Business Activity" | Dr. Rakeshkumar R.Jani | Marketing | 132-136 |
| 43 | Users' Opinion Regarding Advertisements on Social Networking Siteswith Special Reference to Facebook | Priyanka Patel | Marketing | 137-139 |

| | | | | |
|----|--|--|----------------------|---------|
| 44 | Bilateral Accessory Peroneal Muscle - A Case Report | Dr. Renuka B. Adgaonkar, Dr. Archana Shekokar | Medical Science | 140-141 |
| 45 | Decentralization and Dilemmas in Development: A Debate | Dr. N. M. Sali | Political Science | 142-143 |
| 46 | Study of Microstylolites from Carbonate Rocks of Kurnool Group, Andhra Pradesh, South India. | P.Madesh, P.Lokesh Bharani , S.Baby Shwetha | Science | 144-147 |
| 47 | Evolution Of Rural Tourism and Its Prosperity | Joysingha Mishra, | Tourism | 148-150 |



Design and Optimatization, Weight Reduction of Rear Axle Banjo Housing for Light Weight Vehicle.

* S Surya Narayana

* Bharati Vidyapeeth University College of Engineering Pune

ABSTRACT

This paper describes the analysis of Design and optimization, Weigh Reduction of Rear Axle Banjo housing for Light Weight Vehicle using. This paper also discusses several other points of interest in the analysis. These include the vehicle dynamics, Sheet metal designs, Formability, Finite Element Analysis and Manufacturing Process.

This paper is rear axle housings for pickup truck comparison between the Salisbury and Banjo type. Actually the Salisbury model is being currently employed on the project vehicle, so the purpose of this project is to design Banjo axle housing which would be better in terms of strength and reduce weight as compared to the existing model. Rear axle assemblies include a number of components which are adapted to transmit rotational power from an engine of the vehicle to the wheels thereof. Before final assembly of axle housing it has to be analyzed to make sure that it withstands impact and heavy load for safety. Engineering stress estimation is very essential to find safety of the structure. Stress analysis gives prior idea of the structure for optimum results. Many methods like Analytical, Experimental and Numerical methods are available to estimate stress and strain estimates on the problem. But Analytical methods are suitable for simple problems, and Experimental methods are difficult to apply and will not complete information of the problem. Due to this numerical methods are dominated in the stress analysis field. Implementation of Finite Element Methods for structural analysis is possible due to the emergence of fast computing technology. The accuracy of the numerical methods directly depends on the quality of the mesh. So Rear axle assembly design and cad model in Catia V5, Meshing in Hyper mesh, software along with Abacus, Formability analysis in Fast form is considered for analysis. I would compare Salisbury and Banjo rear axle assemblies with respective of strength, weight reduction. The weight of Banjo axle housing is 58.5 kg and Salisbury axle housing is 68.5kg. Directly weight saving 10kgs in rear axle housing, this paper would provide a systematic approach to design and optimization Weigh Reduction of Rear Axle Banjo housing assembly.

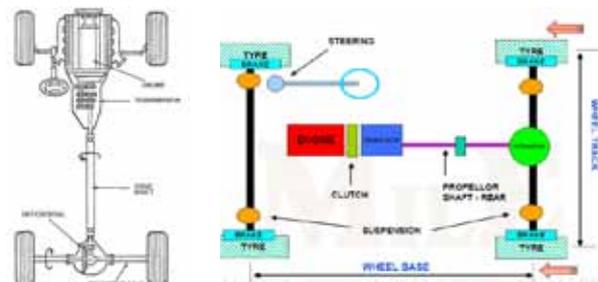
Keywords : Design and Weigh Reduction of Rear Axle Banjo housing, Salisbury and Banjo type, Sheet metal designs, Formability Analysis, Finite Element Analysis, vehicle dynamics, 2-piece banjo axle housing and 3-piece banjo axle housing. Beaming analysis and the initial brake torque analysis

INTRODUCTION:

The rear axle is part of the power train of a rear-wheel-drive vehicle. The term "power train" is used to describe the parts of a vehicle which make the drive wheels move. The primary function of the rear axle is to transfer engine torque (rotating force) from the propeller shaft to the rear wheels. The amount of torque (or rotating force) is measured in new tons per meter at a given speed, measured in revolutions per minute. Since the rotation of the vehicle wheels is perpendicular to the rotation of the propeller shaft, the rear axle is designed to provide a 90° change in rotation the rear axle is also designed to split the engine torque between the two wheels. In a rear-wheel drive vehicle, power from the engine is transmitted through the transmission and propeller shaft to the rear axle. The rear axle provides the torque to the vehicle wheels. All of these components are combined to form the power train of a rear wheel drive vehicle. The speed and acceleration provided by the power train is dependent on all of the components of the power train.

Rear axle assembly, engine power enters the drive pinion gear from the drive shaft assembly and differential pinion yoke/flange. The drive pinion gear, which is in mesh with the ring gear, causes the ring gear to turn. The interaction of the ring and drive pinion gears turns the power flow at a 90°. The difference in the number of teeth on the ring and pinion gears causes a reduction gear ratio. This reduces turning speed, while increasing torque. Power from the ring gear

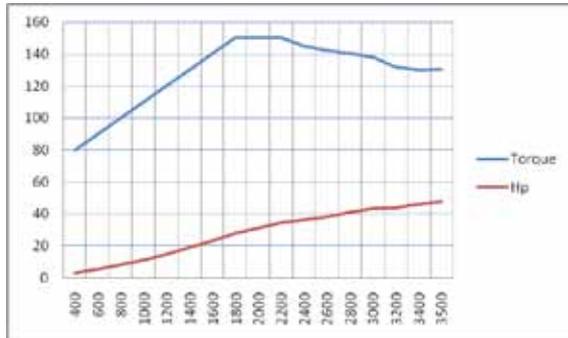
flows through the differential case, spider gears, and side gears to the drive axles. The drive axles transfer power from the differential assembly to the rear wheels. Axle housings are generally classified into Salisbury and Banjo type. Salisbury axle housing type is a unitized carrier construction is directly connected to the two tubes (which house the axle shafts). An opening is provided at the rear of the carrier to permit assembly of the differential there in. This opening is closed by a cover during use. Banjo axle housing type is a separable carrier construction. The axle tubes are connected together by a central member which is formed separate and apart from the carrier. This central member is generally hollow and cylindrical in shape, having a large generally circular opening formed there through. During assembly, the differential is first assembled within the carrier, and then the carrier is secured to the central member.



ENGINEERING ANALYSIS OF REAR AXLE ASSEMBLY:

Maximum Power , $P_e = 47.8 \text{ kw @ } 3500 \text{ rpm}$

Maximum Torque , $T_e = 150 \text{ N-m @ } 1700 - 2200 \text{ rpm}$



Gross Vehicle Weight, $GVW = 2500 \text{ Kg}$; Over load of Vehicle Weight = 3500 Kg

Rear axle side Vehicle Weight = 1450 kg; SLR (statically loaded radius) = 303 mm

Wheel Base , $W = 2800 \text{ mm}$; Rear Truck R = 1360 mm ; Ground Clearance = 180 mm

A is CG from front Axle = 1028 mm; B is CG from Rea Axle = 1772 mm

Height is CG H = 965 mm; Gear Ratios = gr 4.22, 1.75, 1.05, 0.90 & 3.66

Differential ratio ar = 4.4 ; Transmission efficiency h = 90%

Torque at rear wheels, $T_w = (gr \cdot ar) \cdot \eta \cdot T_e = 2645.9 \text{ N-m}$

Tractive efforts, $F_e = \frac{\text{Torque at rear wheels}}{\text{Statically loaded radius}} = 8732.4 \text{ N}$

The speed of the vehicle in km/h = $\frac{2\pi \cdot SLR \cdot 60 \cdot RPM}{1000 \cdot (gr \cdot ar)}$

High speed $V_{a1} = 105 \text{ kmph}$; low speed $V_{a2} = 21.5 \text{ kmph}$;

Braking (commonly considered as 1-2 g load case) = $\mu [W (B/W) + ma((H/W))]$

Vertical (commonly considered as 3 g load case) = $\frac{3}{2} [W (B/W) + ma((H/W))]$

Lateral (commonly considered as 2g load) = $W [H^*g + a^*H] / g^*R$

Rolling resistances = $9.81 \cdot C_{rr} \cdot m \cdot V$ (C_{rr} = coefficient of rolling resistance) / 3600

To get from normalized longitudinal force to actual longitudinal force, multiply by the load on the wheel. $F_{long} = F_n \cdot long \cdot F_z$ where F_n , long is the normalized longitudinal force for a given slip ratio and F_z is the load on the tyre. $F_{long} = C_t \cdot slip \cdot ratio$.

$F_{lateral} = F_n \cdot lat \cdot F_z$ where F_n , lat is the normalized lateral force for a given slip angle and F_z is the load on the tyre.

ANALYSIS OF REAR AXLE ASSEMBLY:

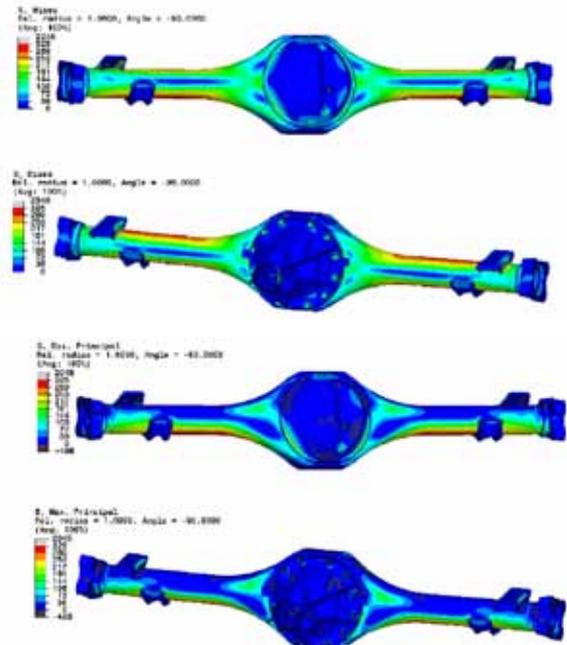
The purpose of this analysis was to determine the stress in the banjo housing assembly under beaming and break torque loads. Fatigue life predictions were also requested.

The carrier, carrier bolts, diff bearings, bearing caps and bolts, diff case, diff pin, and ring gear were modeled. The cover weld was tied to the housing and the cover. The stiffening ring weld was tied to the housing and the stiffening ring. The carrier

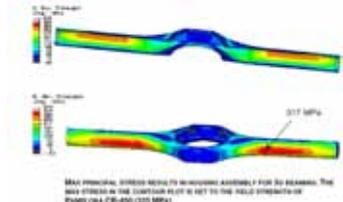
bolts were tied to the housing and stiffening ring. Contact was modeled between the carrier and stiffening ring, between the stiffening ring and housing, and between the cover and housing. All bracket welds and backing plate welds were tied to bracket and housing

The flange faces were connected to a reference node on the same plane, and coincident with the y-axis, via a kinematic coupling. Boundary conditions and loads at the flanges were applied to these reference nodes. The top surfaces of the spring seats were connected to a reference node via a kinematic coupling. Boundary conditions at the spring seats were applied to these reference nodes.

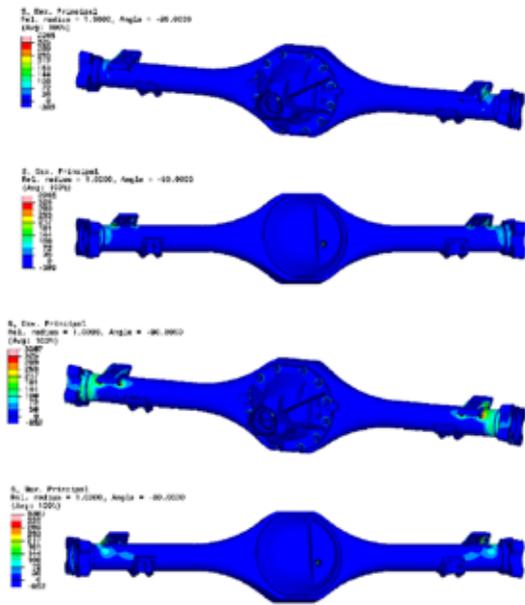
For the beaming analysis and the initial brake torque analysis, the flange reference nodes were not constrained. For the revised braking analysis, the flange reference nodes were only allowed to rotate around the y-axis (axis of the tubes), and translate along the y-axis. For the beaming and braking analyses, one of the spring seat reference nodes was held fixed in all 6 degrees of freedom, except for rotation about the x-axis (the axis approximately parallel to the pinion axis). The other spring seat reference node had the same constraints, except that it was also allowed to translate in the y-direction (along the axis of the tubes). Note that the weld between the two sides of the housing was not modeled. All loads were applied to the reference nodes at the flanges. Because the actual loads are applied at the tread centers and/or SLR (statically loaded radius), equivalent force and moment couples were calculated and applied at the flanges. The 4.5° nose angle was also taken into consideration when calculating the loads to be applied at the flange. For the FEA, elastic properties of steel were used for the housing, cover, brackets and all welds. For the fatigue analysis, Stress results and fatigue life predictions were requested for beaming and braking loads. The results are presented here. Two different sets of boundary conditions were used for the brake torque analysis in section



THE MAXSTRESS TO THE YIELD STRENGTH 325 MPA

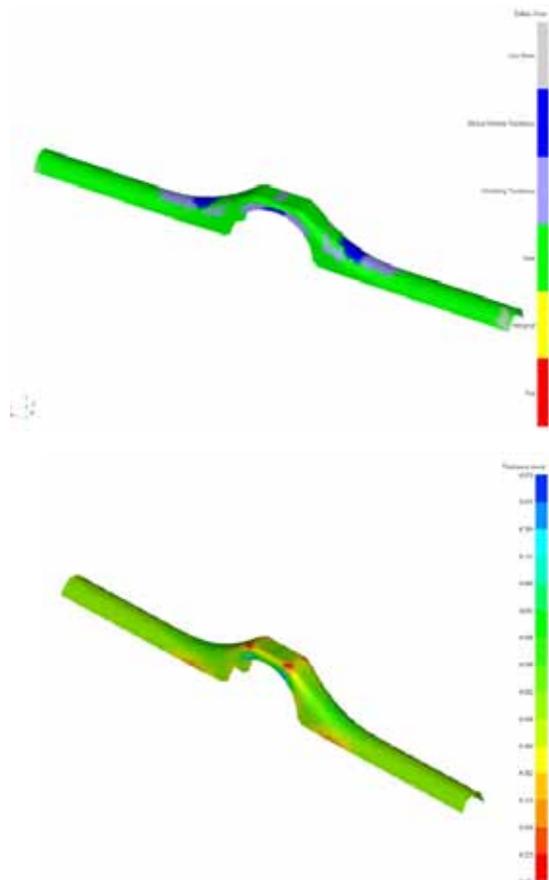


Forming Diagram Thickness Results



THE MAXSTRESS TO THE YIELD STRENGTH 325 MPA

FORMABILITY ANALYSICS OF BANJO HOUSING



RESULTS:

The Rear Axle Housing has been built using Catia V5 imported to hyper mesh. The meshed model has been exported to Abacus for application of boundary conditions and execution. The weight of Banjo axle housing is 58.5 kg and Salisbury axle housing is 68.5kg. Directly weight saving 10kgs, The von Mises and maximum principal stress in the housing assembly and brackets. The stress in the housing does not exceed the yield strength which is approximately 325 MPa. The highest stress is 317 MPa and is on the tensile side of the housing. The highest max principal stress in the assembly is 817 MPa, located in the spring seat weld. The stress for brackets is 818 MPa, The Formability Analysis of banjo 4.5 mm uniform thickness to verify stress results are acceptable.

CONCLUSION

This research work being done in the fruitful results as the design comparison for pick up trucks of rear axle housings was done for the first time. So, what it has been done would provide some kind of base to them so that they could take this to next level by doing some extensive analysis of 2-piece banjo axle housings. The conclusion of this project is very straightforward that banjo axle housing is much better than the Salisbury axle housing, not only in terms of design and analysis but also in terms of manufacturability as discussed earlier. By implementing this axle housing a lot of weight can be saved. There are some scopes of improvement possible in the proposed design of Banjo axle housing with certain modifications required 2-piece banjo axle housings to 3-piece banjo housing; this proposed design of axle housing can be beneficial in terms of materials saving. Thus, the sole purpose of the project which was to analytically prove that 2-piece banjo axle housing is better than the Salisbury axle housing has been fully served both theoretically and analytically.

REFERENCES

1. Dr. Gillespie, Thomas D „Fundamentals of Vehicle Dynamics, SAE International (1992). | 2. Shigely, J.E and Mischke, C. Mechanical Engineering Design, New York: McGraw Hill,Inc. 1989 | 3. Prof R.B.Gupta , Auto Design , New Delhi : Satya Prakashan Tech India 1999. | 4. Milliken,W.F. and Milliken, D.L. Car Vehicle Dynamics SAE International (1995) | 5. Topac,M.M: Gunal, H: Kuralay,N.S, Fatigue Failure prediction of rear axle housing Prototype by using finite element analysis. Engineering Failure Analysis | 6. David E. Woods and Badih A. Jawad. "Numerical Design of Race car Suspension parameters", Washington, D.C.: SAE International, 1999.



Sara Publishing Academy
Indian Journal Of Applied Research
Journal for All Subjects



Editor,
Indian Journal Of Applied Research
8-A, Banans, Opp. SLU Girls College,
New Congres Bhavan, Paldi, Ahmedabad-380006.
Contact.: +91-9824097643 E-mail : editor@ijar.in