Effect of Number of Spot Welds over Stress Distribution and Deflection of Two Piece Scooter Wheel Rim

Hanumant N. Kale, Dr. C. L. Dhamejani

***Abstract*— Wheel rim is an important part of scooter without which any vehicle cannot propel from one position to another. Today vehicles plays very important role in the life of human beings as a transportation medium. There are so many types of wheel rims available in the market for a scooter, but two piece sheet metal wheel rims are widely used due to its good properties such as low cost, better heat dissipation and light in weight. In two piece sheet metal wheel rim central disc is press fitted into a circular rim profile and both piece welded together by spot welding. In this paper we will study the analysis of wheel rim; for that purpose CAD model is created in CATIA Vr.16. IGES format file of CAD model is imported into ANSYS 14.0 where spot welds are applied in between the rim disc and rim profile of some suitable diameter. By applying boundary conditions analysis of rim conducted by varying loading conditions and number of spot welds for maximum displacement and maximum stress induced in a Steel C1008 material wheel rim.**

***Index Terms*— CATIA Vr.16, ANSYS 14.0, Displacement, Maximum Stress, Two Piece wheel rim.**

I. Introduction To Two Piece Wheel Rim

Wheel rim is a part of wheel assembly, which is manufactured from good quality materials such as Al alloys, Mg alloys, Steel and its alloys, Forged steel. Basic requirements of any wheel rims are excellent structural strength, good conductor of heat, excellent corrosion resistance, lighter in weight and pleasant appearance. Following figure shows the two piece wheel rim.

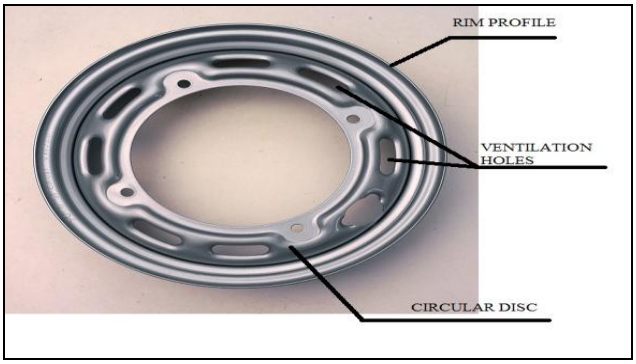

Fig-1: Two piece rim

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Two piece wheel rims contains two main parts circular disc and rim profile, generally that two parts assembled by press fitting followed by spot welding process. Stud holes matches with the bolt position of axle so as rim mounted on the axle.

II. Loading Conditions of Wheel Rim

Wheel rim is subjected to radial inflation pressure, self weight of vehicle, weight of passenger, luggage weight. Inflation pressure is the tyre air pressure acting on the rims; generally its value is taken as constant. Self weight of vehicle is also constant and four passenger weights are considered approximately with some suitable luggage weight. Here total load acting on wheel rim is taken as 2000N.

III. Modeling of Wheel Rim

CAD model of wheel rim is created by using the CATIA Vr.16 in a sketcher mode of software. After modeling that model saved in IGES format further imported into ANSYS where it is meshed by using 10 node tetrahedron elements.

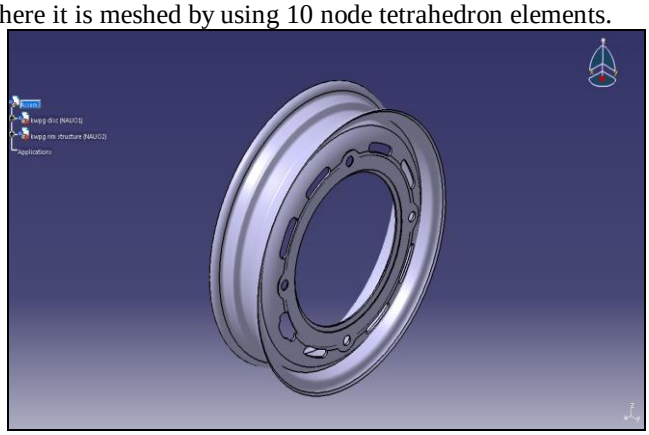

Fig -2: CAD Model of Wheel Rim

Fig -3: Meshing of wheel rim (10 Node Tetrahedron Element)

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CAD model and meshing of wheel rim as shown in figure number 2 and 3 respectively.

IV. BOUNDARY CONDITIONS

Introduction Wheel rim is fixed to the axle hub of scooter on stud holes with the help of bolts; tyre is mounted over the rim in between the left and right board flange over the bead seat area and radial force is acting on the rim vertically downward direction. Following figure shows the boundary condition applied during the analysis of wheel rim.

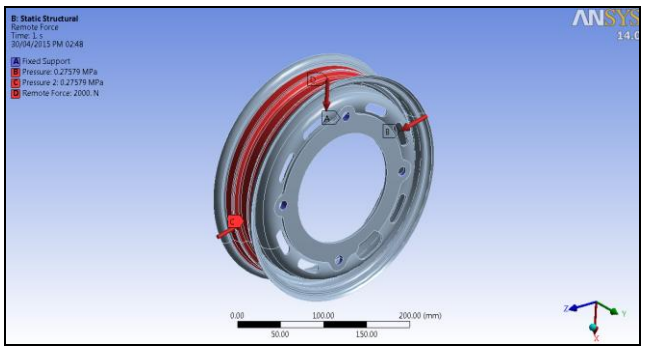

Fig -4: Boundary Conditions applied to Wheel rim for Static Analysis.

V. ANALYSIS OF WHEEL RIM

A. Static Analysis of wheel rim for 24 Spot Welds

Analysis is a best option in order to find out the effect of changing variable parameter over other parameters. Here static analysis reveals effect of total loading over the stress distribution and deformation, so that we can find out the maximum stress induced in a wheel rim and maximum deflection of wheel rim.

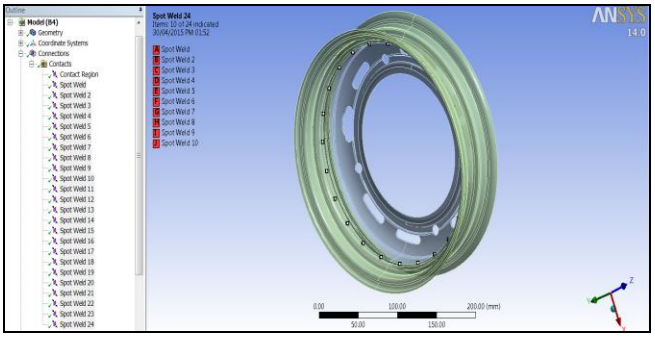

Fig-5: Wheel rim in which disc and circular profile welded by 24 spot welds

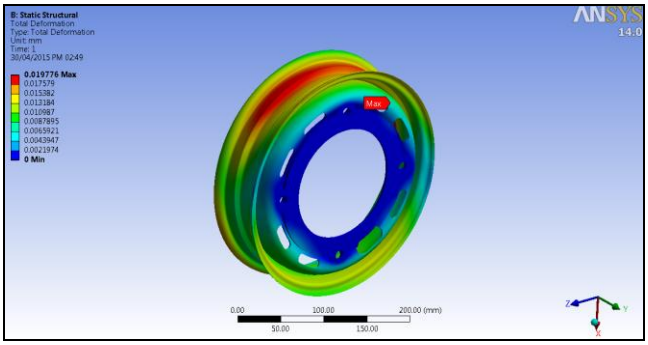

Fig-6: Deformation of wheel rim in which total number of spot welds are 24.

Figure 6 shows the maximum deformation of wheel rim in which disc is welded to rim profile by 24 spot welds. Here maximum deflection is 0.019776 mm.

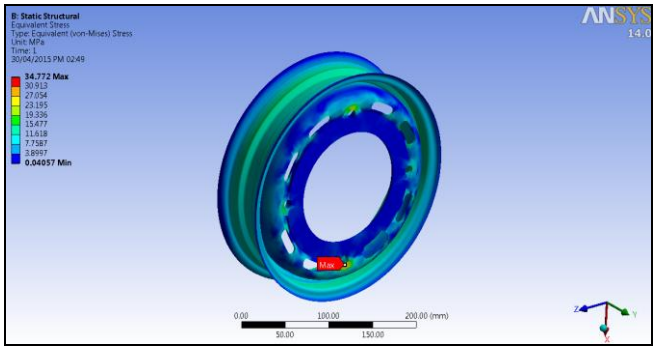

Fig-7: Stress Distribution in a wheel rim

Figure 7 shows the stress distribution in wheel rim under 2000KN load. Maximum stress induced at the stud holes is 30.913 MPa.

B. Static Analysis of wheel rim for 22 Spot Welds

Figure 7 and 8 shows the maximum deflection and stress induced in wheel rim in which rim disc and profile is welded by 22 spot welds. Value of maximum deflection and stress induced are 0.025575 mm and 47.113MPa respectively.

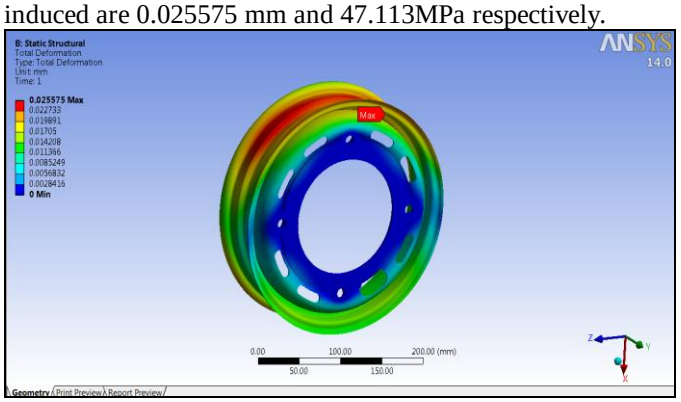

Fig- 8: Deflection of wheel rim having 22 spot welds

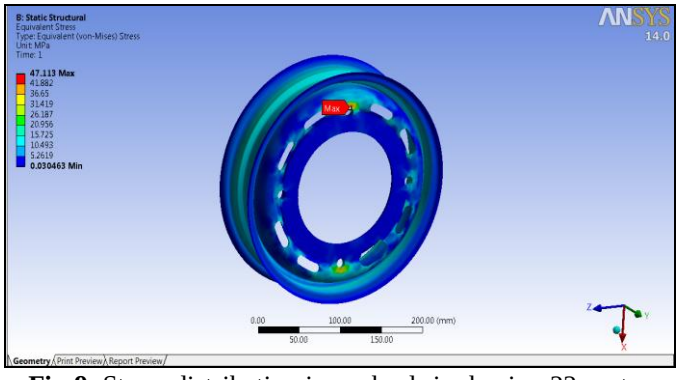

Fig-9: Stress distribution in a wheel rim having 22 spot welds.

VI. CONCLUSION

Static analysis clearly reveals that stress induced as well as deflection of wheel rim goes on increasing if number of spot welds decreased for constant loading conditions of wheel rim.

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