

*Review on Various Analysis of Riveted Joints*¹Khaja Abulfaiz A.H., ²R.D. Shelke¹ Student, Department of Mechanical engineering, EESCOET, Aurangabad.² HOD, Assistant Professor, Department of Mechanical engineering, EESCOET, Aurangabad.**Abstract**

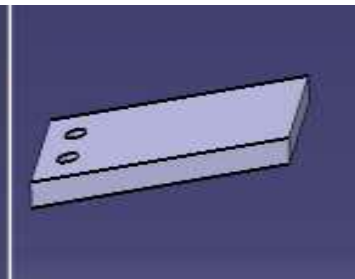
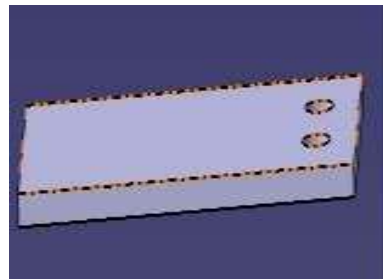
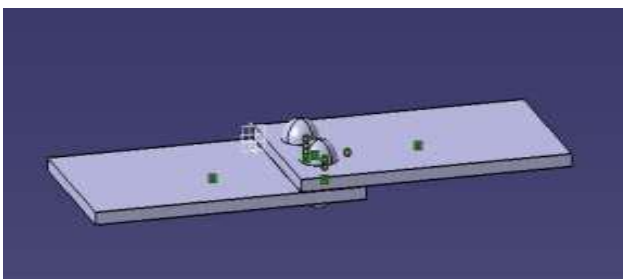
This research deals with the vibration analysis of riveted lap joints, which involves appropriate pattern and characterization of these joints for maximum utilization. The present study includes the effectiveness of riveting patterns or configuration. We have placed the rivets at different places at the time of joining the plates by riveted joint and also calculated the damping strength of joint with comparison of different pattern of riveted joints. By using CATIA we modeled the different patterns of riveting then we simulated using ANSYS for analysis of vibration frequencies. It is found that the results obtained computationally are compared with the experiments. The vibration analysis is carried out using FFT analyzer.

Keywords: ANSYS Workbench, Riveted Lap joint, FFT analyzer, Vibrational Analysis.

1. Introduction

Manufacturing large and complex structures is usually possible only when they are made by assemblies of smaller parts joined together by using various joining techniques since most products are impossible to be produced as a single piece. Manufacturing small components and then joining them into a single product is easier and less expensive than manufacturing the whole product as a single piece. In order to ensure the manufacturing ability, and reduce the overall manufacturing cost, economic fastening and joining method should be utilized. Riveted joints are widely used in various industries such as automotive, Boiler, chemical industry, electrical industry, aircraft and even in cryogenics.

In engineering applications it is often required that two sheets or plates are joined together and subjected to the load in such ways that the joint is loaded. Many times such joints are required to be leak proof so that gas contained inside is not allowed to escape out. A riveted joint is easily applied between two plates overlapping at edges, making holes through thickness of both, passing the stem of rivet through holes and creating the head at the end of the stem on the other side. A number of rivets may pass through the holes, which are uniformly distributed along the edges of the plate. With such a joint created between two plates, they cannot be pulled apart. If excitation is applied to free end then continues damping force is developed on plate surfaces. Such joints have been used in structures, boilers, ships and automobiles.



2. Literature review

B.C.Huskamuri et.al. [1] This project deals with the shear strength analysis of riveted joints. This investigation provides the study of various design parameters are considered and effect of this parameter on shear strength of riveted lap joint is discussed. Like, in single chain riveting for same diameter of rivets if thickness of plates to be joined is increased beyond the recommended value then shear strength of joint decreased. Experimental results shows that as pitch is increases at different thickness of joint which increases shear strength of joint. And in case of double chain riveting, variation in pitch and thickness of plate shows good shear strength for its recommended values as compare to single chain riveting.

As comparing with Ansys result that also verify that increasing of joint strength by varying the pitch, transverse pitch and thickness of plate.

V. K. Khemnar et.al. [2] Has investigated that hybrid joints have a mixture of adhesive bonding and mechanical fasteners. The advantages of using a combined bonded-riveted design apply mainly in joining process. It is generally accepted that a bonded joint is stronger than a mechanically fastened joint and a well-designed bonded joint is stronger than a hybrid joints. A 'Hybrid Joint' combines multiple joining methodologies. A basic example is the bonded and bolted joint. It has been observed that it is possible to improve strength and fatigue characteristics of bonded joints through the inclusion of a single, or multiple, reinforcing bolts. Advanced hybrid joints typically use more accurate mechanically interlocking. In experiment three types of riveting pattern has been used (Transverse, longitudinal and triangular rivet arrangements). At the end of study maximum shear stress and displacement of rivet and adhesive layer has been observed and it is observed that the performance of longitudinal rivet arrangement is good as compare to other arrangements.

Suyogkumar W. Balbudhe et.al. [3] This project deals with the stress analysis of riveted lap joints with various arrangements of riveted lap joints (Chain riveting, zigzag riveting and diamond riveting). The study also correlate the maximum shear stress and maximum principal stress with pitch of rivet. And performance of riveting pattern under maximum shear stress and maximum principal stress has been focused. This work involves the suggestion of appropriate configuration and pattern of these joints for maximum utilization.

Kale Suresh et.al. [4] Discussed about the analysis of adhesively bonded single lap riveted joints. The study of this project involves the suggestion of appropriate configuration and characterization for maximum utilization of adhesively bonded riveted lap joints. And this project also involves the study of efficiency and life span of riveted joints with varying thickness and dissimilar material of joint. The present study includes the effectiveness of bond line thickness and bonded layer configuration with its position to reduce the stress.

M.M.Krishna et.al. [5] Authors discussed about the stress analysis of adhesively bonded riveted lap joints. The presented study for maximum utilization involves the appropriate configuration and characterization of these joints. At present the study of this research includes the effectiveness of bond line thickness and the bonded layer configuration of joints. This is also applicable to dissimilar thickness joints, but in this project adhesives has been placed at different places for riveted joints and also calculated the strength of riveted joint without adhesive by designed it to compare both the joints. By using finite element method, stress carried out under the external tensile loading. Using a two-step simulation, riveting process and subsequent tensile loading of the lap joint are simulated to determine overall stress state.

Prof. Mahavir I. Darda et.al. [6] Basically this research was based on thermal stress analysis of riveted joints. In this investigation two load steps were applied to the model. First, the simulation of riveting was carried out and then an external tensile load was applied to the deformed and residual stress loaded rivet joint. Riveting process is simulated by a simplified method, namely the interference and clamping misfit method. For validating the model, the convergence check study was carried out by altering the overall mesh density of the numerical model. Results of the models with different mesh densities were compared and check for accuracy and convergence of certain values. The analysis in this research has been is executed by running ANSYS/Standard procedure. To understand the dynamic behavior of the joints and the failure modes, the study can be extended by running ANSYS/Explicit procedure to include the time-domain in the analysis because this process will help investigating influences of different parameters on riveted and rivet-bonded joint such as the sensitivity of the strain rate of fracture limits. And at the end it is recommended to carry out some experimental works to verify the results.

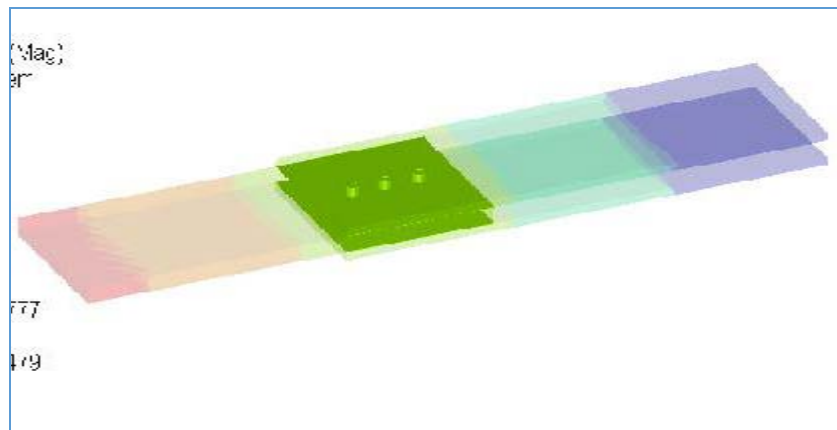
3. Objectives

1. To study effect of geometrical layout of riveted joints on various significant parameters.
2. Determine optimal level of parameters while working on the design aspects of various applications.
3. Recommend best design practices for this type of joint for helping effort over similar applications in the industry.
4. Identify crucial or significant parameter that affect the performance of the joint.

4. Problem Definition

The main focus to carry out research is to find out the optimum damping of riveted joints for its application in industries, where joints are subjected to heavy vibrations. For structures that may contain excessive number of rivets, there is a real need to model the rivets in the structure in an effective way, especially to determine the natural frequencies and mode shapes with acceptable accuracy and also to see the effects of design modifications.

However, this is in focus with the real need in industry due to the serious difficulty of incorporating excessive number of nonlinear joint models in structures such as aircrafts and helicopters. Therefore, there is a real need for developing approaches that will be applicable to model structures of joint with excessive number of rivets and that will also yield acceptable accuracy using quite simple, approximate rivet models.



5. Methodology

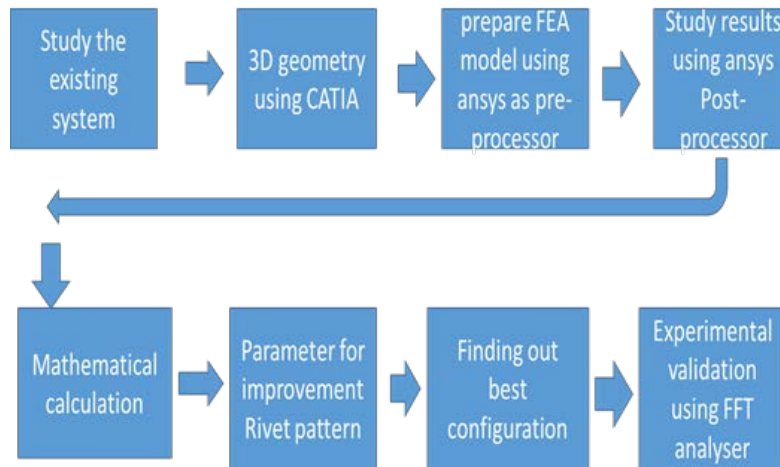


Fig. No. 1. Block diagram of methodology

6. Experimentation

Modeling and static analysis of 3-D Models of the rivet joints shall be carried out using CATIA and ANSYS FEA Workbench software. The results shall be interpreted in terms of displacement and frequency distribution. The present study deals with the analysis of riveted lap joint subjected to the given vibration excitation in the members under various design conditions are found.

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