

Review Paper on Single Bolt Configuration with Different Adhesive

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Abstract - This research is focused to investigate the stress distributions in composite joints with multiple loads using finite element analysis.. Parametric study is conducted to investigate the effect of stress distribution and load. The joint response of various configurations of single lap joints, namely bonded, bonded-bolted joints, is analyzed by finite element method. When compared with bolted and bonded technology in composite structures, hybrid joining technology is at an early stage of development, very few journal papers have been written on this topic as of the time of this writing.

The aim was to investigate the effect of several factors on the joint strength and load sharing in bolted/bonded hybrid joints. In addition to this, finite element modeling was successfully applied to predict the load sharing and strength.

Key Words: Epoxy Resin, CATIA, ANSYS, Bolted Joint, Tensile Loading

1. INTRODUCTION:

The most important composite material used in aircraft structures is the carbon fibre in an epoxy resin matrix, also referred as carbon/epoxy, graphite epoxy or Carbon Fibre Reinforced Plastic (CFRP). The high strength of carbon fibre improves both the high specific strength (strength/density) and specific modulus (modulus/density), even stronger than comparable metal alloys, including the fatigue strength [10]. On the other hand, because there are no fibers oriented in the through-the-thickness direction, the mechanical performance is poor in that direction. Absorption of environmental moisture and temperature also affect the composite performance.

However, hybrid bolted/bonded joint technology is currently in the early stages of research and development and will require extensive research to reach the same level of knowledge as compared to bonded and bolted joint technologies.

1.1 Bolts vs. Screw vs. Stud

Bolts square measure typically outlined as a rib fastener supposed to be mated with a nut, whereas a screw will have interaction either preformed or successful internal threads. Bolts and screws share variety of head shapes and drive configurations. Bolts that have a shank configuration preventing rotation can't be thought of -- or used -- as a screw. Conversely, fasteners with cutting or tapered threads not supposed to mate with a nut, like self-tapping screws, can't be used as bolts. A stud is Associate in Nursing outwardly rib headless fastener. One finish typically mates with a broached part and also the different with a customary nut.

1.2 Bolts/Screws Material

Normally steel materials such as stainless steel, titanium, Montel metal find an application for fixing special purposes, such as. . Medical application. Mounting hardware Screws can be made of many materials, but most screws are made of carbon steel, alloy steel or stainless steel. The stainless steels include both chromium alloys based on iron and nickel. Titanium and aluminum screw are mainly used in the aerospace industry.

The following precautions must be observed:

1. The material of the bolt lining is normally the limiting factor for the maximum operating temperature.

2. Carbon steel and alloy steel are not satisfactory at temperatures below 65 ° C (they become brittle).
3. Hydrogen embrittlement is a problem with most common coating methods unless special procedures are used. (This topic is discussed in more detail in the section on corrosion).
- (4) The 400 CRES series contains only 12% chromium and, therefore,

2. LITERAURE REVIEW

Although plenty of innovations ar occurring within the field of automotive industries and then happened in metal connection work too we've got solely targeted on the lap connection processes mistreatment barred joints and a few of them are conferred during this section. E. Armentani et al. [1] The author will associate analysis of the Structural Behavior of a one-piece Hybrid Seal (Bonded / Screwed) with External Traction Load mistreatment the Finite component technique (FEM). C. Faella,et al., [2] have conferred the experimental results for the most important hinge part, have shown that the slope of the fatigue curve of barred T-bolts is bigger than beam-column joints that are exposed to cycle fatigue.O. Essersi Et Al. [3] has studied the dynamic behavior of the composite assemble. In this paper, a study of the behavior depends on the structure of adhesion-related double overlaps is presented.

S. A. Patil¹ et al., [4] had studied the structural adhesive technology used in various applications in the modern automotive and aerospace industries. RafałGrzejda, [5] had done the modeling and calculations of a bolted overlap. The analysis of forces acting on the bolts using the theoretical formulas and finite element method (FEM) is performed. ZasiahTafheem et al., [6] have describes a Finite Element Method (FE) to simulate the behavior of bent pipe flange steel pipe fittings.

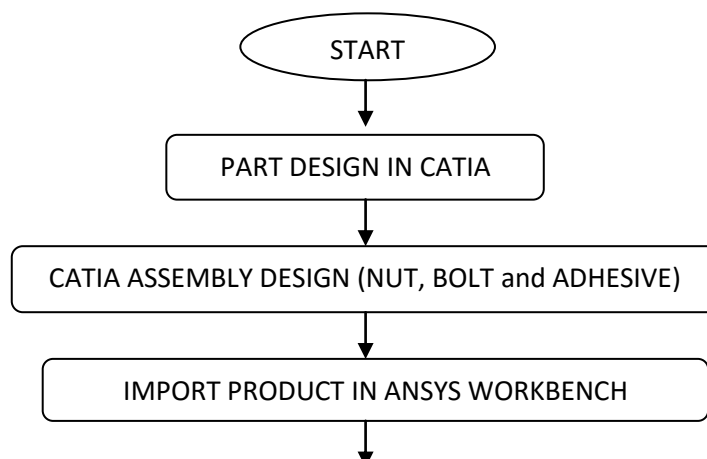
H. Ahmadian et al., [7] have modelled the linear dynamic model for screwed joints and interfaces under development. It can be integrated with existing commercial codes of the finite elements.

MortezaIranzad et al., [8] have observed that the overlap connections have a significant impact on the response of structures due to their localized nonlinear stiffness and damping.

Hassan Jalali et al., [9] have studied that the joints and fasteners often have a significant impact on the dynamic behavior of assembled mechanical structures.

Rafa l Grzejda [10] has presented the modeling of an asymmetric preloaded flange joint with normal external force. The physical model of the connection is designed as a pair of elements (flexible flange element and rigid support) which are tightened with simplified screw models.

3. METHODOLOGY: The whole method is distributed within ANSYS and CATIA package with following steps involved:



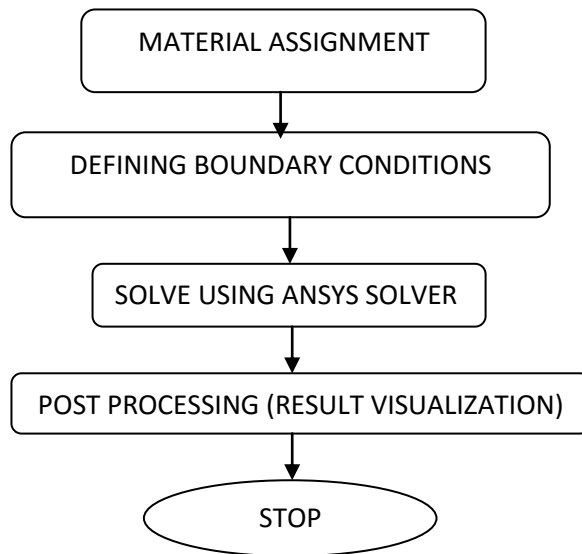


Figure: 3.1 Flow Chart of Analysis

Geometry: strategies to get the pure mathematics may be divided into 2 broad classes—1) Drawing of the pure mathematics within the analysis code or in some cases in another code enclosed with the analysis software; or 2) getting it from a laptop motor-assisted style (CAD) program wherever it absolutely was drawn or mechanically obtained. In present work we've sculpturesque the pure mathematics in CATIA then foreign it to ANSYS for more answer.

Engineering Data: Before more process we want to outline the fabric for the model either from ANSYS Material library or will create our own user outline material.

Meshing: to form the half deformable it's vital to mesh it into little elements. In gift analysis we have a tendency to use a tetrahedral part kind with mesh size variable for plates, bolt and material.

Establishing Connections: The connections between the sex activity surfaces area unit developed for recuperating results to the matter.

Analysis settings: grasp the tensile forces at the acute cross sectional faces area unit provided as boundary conditions for the current analysis.

Solve: Once all the input parameters area unit nominative the ANSYS thinker is named to resolve the matter.

Post Processing: The deformation and stress results area unit obtained once ANSYS thinker solves the matter.

4. FIBER REINFORCED COMPOSITES:

Fiber-reinforced composites have been used consistently in other areas of technology since the late 1960s. Its use has been limited mainly to the aerospace and automotive industries, where the use of lightweight and high strength materials results in significant fuel savings and the potential for increased payload.

The aircraft and automotive parts, traditionally made of aluminum, are being replaced by composite materials. [9] To assess the applicability of composite materials for the bridge infrastructure in the United States, the Federal Highway Administration conducted an exploration mission in Europe (UK, Switzerland, Germany) and Japan, [10] where composites were already used to reinforce the existing bridges , During this survey, applications were identified that did not require any changes in the US. It also highlighted areas where further research was needed before the technology could be implemented in field applications.

In the case of strengthening existing bridges with CFRP composites, additional research must be undertaken, including the development of design guidelines that are in line with US practice. And the development of adequate details to ensure the full participation of the concrete substrate.

5. RESEARCH GAP ANALYSIS

Research Gap Analysis										
Sr. No.	Researcher	Adherent material	Adhesive Material	Method of Analysis			Type of Stresses			
				FEA	Analytical	Experimental	Tensile	Peel	Shear	Cleavage
1	Ramazan Kahraman -2008	Aluminum	two-part epoxy (Fusor 309)	√	-	√	-	-	√	-
2	Jae-Hyun Park -2010	Al alloy 6061-T6	FM73 M epoxy	√	-	√	√	-	-	-
3	Xiaocong He -2011	Composites	Structural adhesives	√	-	-	-	-	√	-
4	Xiaocong He -2012	Aluminum Alloy	acryloid cement	√	-	√	-	-	-	-
5	Yi Hua (2012)	Carbon/epoxy, titanium	FM73	√	-	-	-	√	√	-
6	E.F. Karachalios -2013	High Strength steel	Structural adhesive	√	-	√	√	-	-	-
7	Lijuan Liao -2013	Aluminum, steel	Structural adhesive	√	-	√	√	-	-	-
8	E. Armentani et al. (2018)	structural steel		√	-	√	√	-	√	-
9	C. Faella, et al (1998).	structural steel		√	-	√	-	-	-	-

6. CONCLUSIONS:

From earlier studies on the behavior of bolstered components victimization CFRP composites were conferred. From this review, it is clear that while the benefits of strengthening flexures are well recognized, there are areas where further research is needed. In particular, most previous studies have been conducted on small scale samples where local effects can have a major impact on global response. Composites also provide design flexibility that allows the designer to use the material more effectively.

Under fatigue loading reinforced concrete beams reinforced with CFRP laminate perform better than reinforced concrete beams. The fatigue failure of reinforced beams, however, appears to be controlled by the fracture of the

reinforcing bars during fatigue. Further testing is required to confirm the available results and to evaluate the importance of other variables, such as the configuration of composites.

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