



Analysis and Design of Structural Bonded Joints

Liyong Tong
Grant P. Steven

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Stress Analysis of Structural Bonded Joints D. M. Gleich, 2002 Dissertation is part of a series on the application of advanced sandwich structures Subjects that will be dealt with are e g the design of sandwich structures and stress analysis methods for designing adhesively bonded joints in metals and composite structures Structural Adhesive Joints K. L. Mittal, S. K. Panigrahi, 2020-09-01 This timely book on structural adhesives joints showcases all the pertinent topics and will be of immense value to scientists and engineers in many industries Most structures are comprised of a number of individual parts or components which have to be connected to form a system with integral load transmission path The structural adhesive bonding represents one of the most enabling technologies to fabricate most complex structural configurations involving advanced materials e g composites for load bearing applications Quite recently there has been a lot of activity in harnessing nanotechnology use of nanomaterials in ameliorating the existing or devising better performing structural adhesives The 10 chapters by subject matter experts look at the following issues Surface preparation for structural adhesive joints SAJ Use of nanoparticles in enhancing performance of SAJ Optimization of SAJ Durability aspects of SAJ Debonding of SAJ Fracture mechanics of SAJ Failure analysis of SAJ Damage behavior in functionally graded SAJ Impact shock and vibration characteristics of composites for SAJ Delamination arrest methods in SAJ **Analysis and Design of Structural Bonded Joints**, 1999 **Analysis and Design of Structural Bonded Joints** Liyong Tong, Grant P. Steven, 1999-04-30 254 7 2 AEROSPACE 261 7 3 MARINE 265 7 4 GROUND TRANSPORTATION 268 7 5 CNIL 270 References 285 Index Preface Most structures consist of an assembly of a number of individual components that must be connected to form an integral load transmission path These connections are often referred to as joints and can be achieved in a variety of forms e g by bolting riveting or other forms of mechanical fastening or by welding or brazing for connecting metallic elements or by adhesive bonding No matter what forms of connections are used in the structure these joints are potentially the weakest points in the structure and the locations where a weight penalty may apply Thus structural joints must be designed adequately to meet the specific design requirements Adhesive bonding represents one of the most important enabling technologies for developing innovative design concepts and structural configurations as well as exploiting new materials The evolution of adhesive bonding technology and its current knowledge base was made possible by the explosive growth in the adhesive applications in a great variety of industries over the past few decades While it is easy for everyone to identify examples of adhesive bonding in the world around us analysis and design of structural bonded joints represent one of the most challenging jobs in structural design and manufacturing Compared to other joining methods particularly mechanical fastening adhesive bonding can offer substantial performance and economic advantages **Strength Prediction of Adhesively-Bonded Joints** Raul D. S. G. Campilho, 2017-05-25 Adhesively bonded joints provide many advantages over conventional mechanical fasteners and are increasingly receiving attention as an alternative to mechanical joints in engineering applications The traditional

fasteners usually result in the cutting of fibers and hence the introduction of stress concentrations both of which reduce structural integrity. By contrast bonded joints are more continuous and have potential advantages of strength to weight ratio, design flexibility and ease of fabrication. This book provides an overview of available analytical methods as well as numerical methods.

Structural Adhesive Joints in Engineering Robert D. Adams, J. Comyn, W.C. Wake, 1997-10-31. The use of adhesives has many advantages over other methods of fastening. Presenting a smooth exterior, spreading of the load and ease of joining thin or dissimilar materials are all reasons why the use of adhesives for bonding structures is steadily growing and finding new applications. *Structural Adhesive Joints in Engineering* is a concise guide to adhesive joints within structures, especially those capable of bearing high loads. The book covers all aspects of design, materials selection and testing, including the physical properties and cure chemistry of structural adhesives and how to select adhesives for particular applications, surface preparation by physical or chemical methods with or without the use of primers and coupling agents and new sections on surface analysis and water durability. There is also a detailed guide to stresses in adhesive joints and joint design. Thoroughly revised and updated since the first edition, the Second Edition contains new sections on recent topics of importance such as water durability. This book contains everything an engineer needs to know to be able to design and produce adhesively bonded joints that are required to carry significant loads. Advantages and disadvantages are given together with a sufficient description of the necessary mechanics and chemistry involved to enable the designer to make a sound engineering judgement in each particular case.

Modeling of Adhesively Bonded Joints Lucas F. M. da Silva, 2008-10-14. A lot of recent developments have been made about adhesively bonded joints modeling using various methods of analysis. The increasing application of adhesives in industry is partly due to the increased sophistication and reliability of adhesive joints modeling. The book proposed intends to provide the designer with the most advanced stress analyses techniques in adhesive joints to reinforce the use of this promising bonding technique.

Adhesively Bonded Joints W. Steven Johnson, 1988. *Metals Abstracts*, 1993. **Recent Advances in Structural Joints and Repairs for Composite Materials** Liyong Tong, C. Soutis, 2013-03-09. Joints in components or structures incur a weight penalty, are a source of failure, cause manufacturing problems and are unfortunately unavoidable in most structures ranging from aircraft and spacecraft to ships and offshore platforms to automobiles, bridges and buildings. An important requirement for the complete design of practical structures is the development of attachment methods and joint designs. *Recent Advances in Structural Joints and Repairs for Composite Materials* provides an up to date account of adhesively bonded and mechanically fastened joints and repairs. Audience: This book will prove to be an informative resource for all engineers and researchers involved with joining and repair of composite structures.

Numerical Analysis of Adhesively Bonded Single Lap Joints Under High Speed Tensile Loading Sean M. McCann, 2015. Adhesively bonded joints pose complex solid mechanics problems through their inherent variations, material properties dependent on fabrication, stress singularities created by

geometry of bonded structural assembly and in a non uniform state of stress when loaded When testing adhesives at high strain rates additional variations are observed particularly in strength It is hypothesized that a non uniform field of constitutive relations exists in an adhesive lap joint owing to the strain rate sensitivity of the adhesive material This study investigates the non uniform distribution of strain rate in the overlap region of ASTM D3165 and D5656 single lap joint SLJ specimens and how the strain rate sensitivity of the adhesive affects the stress distribution when the joint is subjected to varying tensile loading speeds The numerical method of Finite Element Analysis FEA has been used to analyze the joint Commercially available LS DYNA implicit dynamics solver and one of its standard material formulations MAT_19_STRAIN_RATE_DEPENDENT_PLASTICITY were implemented to model incremental stiffness as a function of effective strain rate within the adhesive lap joint This thesis reports strain rates at various locations in the adhesive overlap for four test speeds from 25 4 mm s to 1270 mm s Results of stress distributions of the joint are presented comparing the relative effects of using strain rate insensitive and strain rate sensitive material models Comparative results show that while the force vs displacement curves show negligible change strain rate levels and stresses at the bondline edge increase significantly with test speed As this location is known to be site of failure initiation these results indicate this may be an underlying mechanism controlling or at least affecting failure strengths of adhesive joints tested at high loading rates

The Mechanics of Adhesives in Composite and Metal Joints Magd Abdel Wahab, 2014-04-07 Scientific background and practical methods for modeling adhered joints Tools for analyzing stress fracture fatigue crack propagation thermal diffusion and coupled thermal stress diffusion stress as well as life prediction of joints Book includes access to downloadable macrofiles for ANSYS This text investigates the mechanics of adhesively bonded composite and metallic joints using finite element analysis and more specifically ANSYS the basics of which are presented The book provides engineers and scientists with the technical know how to simulate a variety of adhesively bonded joints using ANSYS It explains how to model stress fracture fatigue crack propagation thermal diffusion and coupled field analysis of the following single lap double lap lap strap cracked lap shear butt and cantilevered beam joints Readers receive free digital access to a variety of input and program data which can be downloaded as macrofiles for modeling with ANSYS

Adhesive Joints K.L. Mittal, 2012-12-06 This volume documents the proceedings of the International Symposium on Adhesive Joints Formation Characteristics and Testing held under the auspices of the Division of Polymer Materials Science and Engineering of the American Chemical Society in Kansas City MO September 12 17 1982 There is a myriad of applications ranging from aerospace to surgery where adhesives are used to join different materials and concomitantly the understanding of the behavior of adhesive joints becomes very important There are many factors which can influence the behavior of adhesive joints e g substrate preparation in terfacial aspects joint design mode of stress external environment etc and in order to understand the joint behavior in a holistic manner one must take due cognizance of all these germane factors So this symposium was planned to address not only how to make acceptable

bonds but their characterization durability and testing were also accorded due consideration

The Development of Nonlinear Analysis Methods for Bonded Joints in Advanced Filamentary Composite Structures Glenn C. Grimes, Air Force Flight Dynamics Laboratory (U.S.), L. F. Greimann, Southwest Research Institute, T. Wah, G. E. Commerford, W. R. Blackstone, SOUTHWEST RESEARCH INST SAN ANTONIO TX., 1972 Development of analysis methods for orthotropic adherend bonded lap joints which account for material nonlinearities at room temperature is presented The use of these methods in predicting mechanical behavior ultimate loads and failure modes is discussed In order to accomplish this new analytical procedures were developed and successfully checked with discrete element techniques for single double and step lap adhesively bonded attachment configurations Experimental verification of these nonlinear analyses was accomplished by the fabrication and evaluation of a variety of simple joint specimens under static monotonically increasing load Failure loads and modes were used as the primary substantiation characteristics but the mechanical behavior of a small number of these simple joint specimens was observed at intermediate loadings and found to compare favorably with the analytically predicted behavior Larger more complex bonded joints were designed fabricated and evaluated under static monotonically increasing loads at room temperature utilizing these methods Ultimate load failure mode and detailed strain behavior at any intermediate load were accurately predicted with the new analyses as substantiated by experimental observations These techniques were put into a computerized design analysis program for structural application use and the program was used to generate bonded joint design allowable curves Author modified PL

Environmental Durability of Adhesively Bonded Joints Brown, SR., LR. Pitrone, 1988 Effective determination of adhesively bonded joint durability is crucial for reliable component design and realization of advanced performance In order to model bond endurance in a manner more consistent with severe service environments a cyclic stress durability apparatus that achieved constant shear stress without loss due to creep relaxation was designed and implemented for accelerated joint durability analysis of two modified epoxy based structural adhesives Results were compared with those achieved by sustained stress durability

Further Developments in the Design and Analysis of Adhesive-Bonded Structural Joints LJ. Hart-Smith, 1981 Previous elastic plastic analysis of adhesive bonded joints has covered double lap single lap scarf and stepped lap joint configurations in which the adhesive was considered to be uniform throughout As part of the Primary Adhesively Bonded Structure Technology PABST program the earlier computer programs for analyzing stepped lap adhesive bonded joints and doublers A4EG and A4EH were modified to permit the inclusion of variable adhesives as well as nonuniform adherends This paper presents the results of the modifications The features of the latest version of the analysis program A4EI are described and examples show the effects of load redistribution around flaws and porosity These examples are significant in establishing realistic inspection and acceptance criteria for bonded structures The loss of strength associated with pinched off edges is illustrated and the benefits of deliberately thickening the adhesive layer in the immediate vicinity of the ends of the overlap are documented The

changes in shear load transfer due to softening of some of the adhesive by moisture absorption while the remainder either has never been soaked or has dried out locally are discussed PABST experience and the analyses indicate that bonded structure is more tolerant of bond flaws than was once believed Other new features of the A4EI program include the provision for applying a running shear load along the length of the joint as for a wing spar and a separate calculation for the residual thermal stresses in the absence of external load when bonding fibrous composites to metal fittings A modification of the coding logic has shortened run times for the various cases which now include analysis of internal stresses associated with specified load levels in addition to the elastic and elastic plastic strengths which could be computed by the earlier programs Both single and double bond surfaces can be specified

Science Citation Index ,1994 Vols for 1964 have guides and journal lists

Viscoelastic Analysis of Adhesively Bonded Joints ,1980 *Analysis of Bonded Joints* S. Srinivas,1975

The Analysis and Design of Composite Material Bonded Joints W. James Renton,Donald L. Flaggs,Jack R. Vinson,DELAWARE UNIV NEWARK DEPT OF MECHANICAL AND AEROSPACE ENGINEERING.,1978 Recent experiments have shown that significant improvements can be made in the structural efficiency of single lap joints through several modifications Tests have been conducted in which the adherends were linearly tapered from full panel thickness to practically zero thickness over the length of the bondline in the load direction Further tests were conducted to examine the effects of introducing small grooves on the adhesive side of the adherends perpendicular to the load direction Similarly grooves only over the thicker half of the tapered adherend were investigated because these grooves do introduce stress concentrations In each case significant improvements in joint efficiency were made under either static or fatigue loadings Additionally specific observations are made pertaining to the residual strain effect due to joint fabrication on the fatigue life of strain effect due to joint fabrication on the fatigue life of the joint Second studies were made on the effects of using hybrid adherends and their effect on joint efficiency

Whispering the Techniques of Language: An Psychological Journey through **Streb Analysis Of Structural Bonded Joints**

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