Preface

Adhesives have been used for thousands of years, but until 100 years ago, the vast majority were from natural products such as bones, skins, fish, milk, and plants. Since about 1900, adhesives based on synthetic polymers have been introduced, but these were at first of limited use as they were expensive and had poor mechanical properties. Since 1940, there has been a rapid expansion of the chemical knowledge of polymers from which structural adhesives can be made, with a consequent improvement in their properties and reduction of their cost. Today, there are many industrial uses of structural adhesives, particularly in aerospace, but increasingly in automotive applications where the need is to join sheets of dissimilar adhesives to produce lightweight car bodies.

In the old days, adhesive use was based on trial and error, together with experience of what was known to work, without any real means of optimisation. With modern technological needs and assisted by modern computers and experimental techniques, it is now possible to asses the performance of adhesively bonded joints before committing a design to manufacture. At least, that is the intention. Reality is such that we need continually to improve and develop these techniques as definitive and certain answers are still not available. Even now, we rely to a significant extent on trial and error and to test prototypes or coupons to validate (or to check) the theoretical predictions.

The objective of this book is to bring together some of the latest thinking on available predictive technology for structural bonded joints, using internationally renowned authors who are authorities in their fields.

There are two basic ways of analysing the performance of a joint. In the old days, before we had advanced computers, we relied on algebraic methods, using a range of simple or complex formulae. It was difficult or impossible to solve most of these algebraic formulations in a closed form and so we relied to some extent on numerical solutions. Even those solutions we could obtain were often so complex that it took several minutes to calculate a single point by hand. However, modern computers can now be programmed to solve these complex formulae on a point by point basis since they can calculate the values in microseconds. These "old" algebraic formulae have therefore gained a new lease of life and can, for relatively simple joint geometries, give a good indication of the stresses and strains in a joint. Since 1970, the numerical technique called finite element analysis has been developed from a crude and essentially a research tool into a sophisticated commercially available system. The facilitator has been the parallel development of digital computers. These computers have become faster and able to tackle large numerical calculations on even a lap top computer. Indeed, a modern lap top can give results in seconds that in 1980 would have had a turn round time of a day or more using a large main frame computer such as might be found in a university or a large industrial company. For example, a modern motor car contains more computing power than was used for the first space landings in 1970.

For anyone wanting to understand how adhesive joints will behave under significant loads and how you might go about getting a design load, this book provides an excellent review of the most up to date thinking and practice.

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