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# Designing Plastic Parts for Assembly

Paul A. Tres

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Vorwort

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# Preface to the Sixth Edition

As a design engineer in the automotive industry, I have experienced firsthand how powerful a resource Paul Tres' *Designing Plastic Parts for Assembly* can be. Not only does the text cover the general properties of most plastics; it also utilizes contemporary, real-world examples to illustrate how these properties impact product design. The book is an excellent reference for experienced engineers and, at the same time, it does a superb job of educating the novice designer. A noteworthy addition in the sixth edition is a new cutting-edge materials section.

The book's early chapters start out by defining the differences between thermosets and thermoplastics, and go on to discuss crystalline versus amorphous plastic properties. This sounds simple enough, but I see the effects of poor material selection in my position all too frequently, and the end result is always wasted money. With the basics defined, Tres goes on to discuss the typical mechanical and thermal properties of common plastics. This, combined with the "Strength of Materials for Plastics" overview, leads the reader into the design chapters of the book equipped with the tools needed to maximize the messages of Tres' real-world examples. It quickly becomes obvious that spending the appropriate amount of time in the design phase of any component, especially where tooling costs are high, is critical to the functional and economic success of the part.

Tres also does a good job describing the joining techniques available to present-day plastic part designers. His inclusion of the surface preparation requirements associated with the various welding techniques is of particular importance to novice designers, as it details the sometimes hidden costs associated with each selection. From here, Tres guides the reader through the proper design of press fits, living hinges and snap fits. Again, each design section is reinforced with modern examples and common pitfalls.

I think it's worth mentioning that I have personally coordinated two three-day seminars with Paul at the Mercedes-Benz Training Institute, to investigate injection molding part-design and tooling issues introduced in the book in greater detail. I have also recommended his services to other organizations inside and outside the auto industry. Since reading the book years ago and using Paul Tres as a consultant, *Designing Plastic Parts for Assembly* has become must-have literature for anyone joining the interiors design department at Mercedes-Benz U.S. International. I have no reservations about enthusiastically recommending this book to anyone involved in the field of plastic parts design.

Don't let the patchy beard Paul is sporting on the jacket of this book fool you – he is truly a gifted professional in the plastics field.

Tuscaloosa, Alabama

Jeff Lubbers, P.E.  
Mercedes-Benz U.S. International

# Foreword to First Edition

Knowing well the work and many special talents of Paul A. Tres, I take delight in the opportunity to introduce his new book, *Designing Plastic Parts for Assembly*, and recommend it to a broad range of readers. Material engineers, design and manufacturing engineers, graduate and under-graduate students, and all others with an interest in design for assembly or plastic components development now have a clearly written, method-oriented resource.

This practical book is an outgrowth of the like-named University of Wisconsin – Madison course which is being offered nationally and internationally. Just as his lectures in the course provide a detailed yet simplified discussion of material selection, manufacturing techniques, and assembly procedures, this book will make his unique expertise and effective teaching method available to a much larger audience.

Mr. Tres's highly successful instructional approach is evident throughout the book. Combining fundamental facts with practical techniques and a down-to-earth philosophy, he discusses in detail joint design and joint purpose, the geometry and nature of the component parts, the type of loads involved, and other vital information crucial to success in this dynamic field. Treatment of this material is at all times practice-oriented and focuses on everyday problems and situations.

In addition to plastics, Mr. Tres has expert knowledge in computer software, having directed the development of DuPont's design software. The course at the University of Wisconsin – Madison is indirectly an outgrowth of the software he designed for living hinges and snap fits at DuPont.

Mr. Tres holds numerous patents in the plastics field. He is known worldwide for his expertise in computer programming, manufacturing processes, material selection and project management on both a national and international scale.

Most recently, Mr. Tres's accomplishments have earned him the DuPont Automotive Marketing Excellence Award as well as recognition in the 1994–1995 edition of Who's Who Worldwide.

Whether you are just entering the field, or are a seasoned plastic parts designer, *Designing Plastic Parts for Assembly* is an excellent tool that will facilitate cost-effective design decisions, and help to ensure that the plastic parts and products you design stand up under use.

Madison, WI

*Dr. Donald E. Baxa*  
University of Wisconsin-Madison

# Preface to First Edition

It gives me great pleasure to write this preface for such an important contribution to engineering design. It is rather sad fact that while the creative use of plastics has changed the very structure of consumer products over the past decade, many engineering students graduate with very little knowledge of polymer engineering or plastic design principles. This book written by a recognized expert and practitioner in the field of plastic component design is both a valuable text for engineering courses and a resource for practicing design engineers.

The full potential for the use of plastics in consumer products became recognized in the mid 1980s through the pioneering development of the IBM ProPrinter. The ProPrinter destroyed the myth, prevalent amongst product engineers at that time, that such design elements as plastic springs, plastic bearings, plastic securing elements, etc., lacked the structural integrity of their more common metal counterparts. In the ProPrinter, not only were these plastic design features shown to have the required reliability in regular use and abuse, they were combined into single parts to produce a new level of design elegance. For example, the injection molded side-frames of the ProPrinter, which support the rollers and lead screw, incorporated bearings for all of these rotating members, springs to maintain the required paper pressure, and cantilever securing elements to allow the frames to be snap fitted into the base. The result of such innovative design details produced a desktop printer which could be assembled in only 32 final assembly steps compared to the 185 steps required to assemble its main competitor in the marketplace.

Since the emergence of the ProPrinter, smart plastic design has become an essential tool in the competitive battle to produce products which have simpler structures with smaller numbers of discrete parts. Part count reduction, in particular, has been shown, through numerous case studies published over the past five years, to have a ripple effect on product manufacture which improves the efficiency of the entire organization. Fewer parts means fewer manufacturing and assembly steps, and fewer joints and interfaces, all of which have a positive effect on quality and reliability. Moreover, a reduction in the number of the parts results in a direct attack on the hidden or overhead cost of an organization. Thus, fewer parts also mean fewer vendors for purchasing to deal with, less documentation, smaller inventory levels, less inspection, simpler production scheduling and so on.

*Designing Plastic Parts for Assembly* tackles all of the important issues to be faced in designing multi-feature complex plastic parts. The book is thus much more than its title suggests. It deals with essential fundamentals for the development of competitive consumer products.

Providence, Rhode Island

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