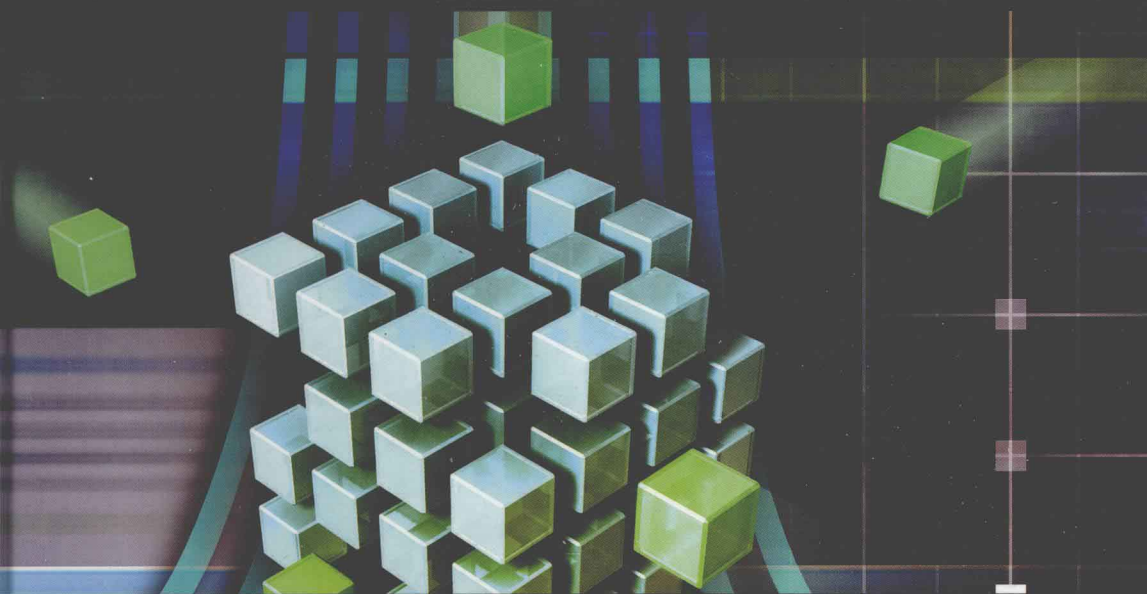




Geometric Tolerancing of Products

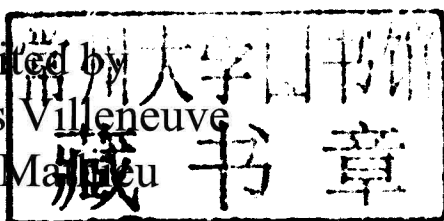
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Geometric Tolerancing of Products

Edited by
François Villeneuve
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PART I

Geometric Tolerancing Issues

Chapter 1

Current and Future Issues in Tolerancing: the GD&T French Research Group (TRG) Contribution

1.1. Introduction

This book, entitled *Geometric Tolerancing of Products*, shows that especially in France a wealth of research work exists in this domain. This work highlights some difficult scientific stumbling blocks, the removal of which is of great importance in pursuing innovation in the development of industrial products. For many years this work has appeared limited, in terms of its response to specific problems concerning the different jobs in engineering (design, manufacturing methods, assembly methods, production and control). It is now, however, moving in new directions in the control of product/process integration, helping towards the development of the PLM (product life-cycle management) concept in companies.

Even though the geometric performance of the means of production has progressed enormously over recent decades, geometric variations in the manufactured products exist and probably always will. Certainly the geometric defects observed have diminished in size but they are always there and play an important role in the quality and cost of products. Mastering these geometric variations throughout the product life cycle remains an undeniable performance

factor for companies. Moreover, in the “virtual” and simulation era, it is no longer sufficient to design numerical models in CAD representing an ideal geometry. It is becoming increasingly crucial to make a realistic simulation of all of the behaviors, products, manufacturing, assembly, disassembly and control processes, and each of these in 3D. Finally, no model can be validated without being used in a real situation. The important recent developments in dimensional metrology, as much in mechanics as in optics, must also be employed in order to identify the parameters causing the deviations generated by manufacturing processes.

These new challenges for the industrial world have greatly encouraged research into tolerancing and this activity is not new. It was initiated in France in the 1970s in the ENS de Cachan, by Professors Pierre Bourdet and André Clément, among others. Their work revealed research areas to others, thus leading to the creation of research groups across the whole country. The aim of this book is not only to propose a synthesis of the most recent research results of the different French research teams today, but also to offer a shared vision of examples in common resulting from a regular exchange of views that have animated meetings of the Tolerancing Research Group (TRG) since 2001.

1.2. Presentation of the Tolerancing Research Group: objectives and function

The first discussions about the creation of the Tolerancing Research Group (TRG) go back to April 2001 at the AIP-Priméca Colloquium, which takes place every two years at La Plagne. The TRG was officially created on April 24, 2001 at the Ecole Normale Supérieure of Cachan, during a work meeting on the occasion of the international seminar on computer-aided tolerancing of the International Academy for Production Engineering (CIRP). François Villeneuve from UJF Grenoble, University of Grenoble, and Luc Mathieu from CNAM Paris created this group, which they head to this day.

One of the motivations for the creation of the TRG was the increasing interest in geometric tolerance and verification, or in other terms for tolerancing and measurement, as much in the research milieu as in the industrial one. This is in contrast to the fact that French research into tolerancing is particularly active all over the country. The first observations on this theme are that it:

- concerns an increasing number of research teams;
- reveals some difficult problems that are still poorly resolved;
- is the object of increasing demand for modeling by the industry;
- generates few tools in the systems assisted by computer (XAO);
- is the object of an international standardization, which is being restructured;
- is particularly well suited to PLM.