

Preface

This book concerns itself with the key scientific disciplines of *Machine Tool Metrology*, which has long been considered something of a Black-art by many industrial users for this type of machine tool plant and associated metrology equipment. Invariably, a highly-productive machine tool situated in certain unenlightened production shops has, in fact, probably never actually been reverified, or recalibrated since the day of its original delivery and installation. Such a lack of any form of verification and metrological testing procedures in today's industrial climate of continuously-improving machined component quality and its accompanying lean-production methods seems somewhat unthinkable. Nonetheless, such a lack of subsequent testing is habitually the case in many of these workshops, being a somewhat dubious practice which seriously needs addressing. This lack of some form of basic assessment and to a certain extent indifferent attitude to calibration issues in general, is one of the major reasons for this current undertaking on machine tool metrology. Quick health checks are made both speedily and efficiently nowadays with pertinent software updates to significantly improve both the machine and its kinematic performance by specific adjustments to the machine's CNC controller. These diagnostic and remedial actions should be a mandatory activity in any industrial, or high-quality research environment, where exceedingly accurate and precise components must be consistently manufactured or tested. Just as important as the fact that such expensive and sophisticated machine tools need to be regularly verified and recalibrated, the associated metrological artefacts for this machine verification must also have measurement capability critically assessed periodically making them traceable to the relevant International Standards. Instruments and equipment such as laser interferometers, telescoping ballbars, precision artefacts, coordinate measuring machines, together with a wide range of metrological hand tools must also be subject to this periodic reverification, so that any potential likelihood of uncertainty of measurement is effectively minimised.

The current text herein concerning topics relating to *Machine Tool Metrology*, has been principally written for the industrial practitioner, rather than as a comprehensive academic work for perhaps an applied researcher—the latter of whom

would normally require significantly more in the way of specific mathematical content, scientific analyses and academic rigour. Within this current level of industrial content, significant and considerable usage has been made of the existing published literature and valid information obtained from a wide spectrum of manufacturers of plant, equipment and instrumentation. In order to make the overall text (hopefully) easier to both read and comprehend, any of the metrological and calibration subjects discussed herein have been to a certain extent deconstructed, where applicable, into simple bullet-pointed explanatory lists with certain facts and words being overly stressed, somewhat more than would usually be necessary. Moreover, the mathematical treatment in certain circumstances has also been intentionally over-simplified, as much as possible, and this level of arithmetic brevity has been utilised where it was considered to be absolutely necessary.

Significant use has been made of a voluminous amount of footnotes utilised throughout all of the chapters, which it is hoped adds some additional, but relevant detail to the subject currently being mentioned at that instance—within the text. Moreover, in many circumstances, briefly the background of the scientific contributor, or originator of the topic under discussion has been mentioned, to add some added-value to their intensive and often life-time's work. As can be seen, an extensive amount of photographic support has also been incorporated into this book, thus enhancing the comprehension to the reader of the facts being discussed at that time. Furthermore, just a brief sample of the applicable references are also included at the end of each chapter, for any readers requiring perhaps more detailed information on the topics covered within the text, together with the relevant appendices that may also offer some additional technical clarification on both validation and testing issues concerning these metrological and calibration topics. An abridged list has also been supplied of some of the international metrology addresses for a wide range of countries, relating to their respective Standards Organisations and Metrology Laboratories. Finally, the international companies that have supplied information in this current text are duly acknowledged and their addresses are produced alphabetically for further reference, also at the end of this book.

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