Preface

The machine tool has been, is and no doubt will be, a key factor in industrial and equipment evolution, and as such, improving man's quality of life. Both its evolution and perfectioning have come about due to the sectors where used and have likewise improved their products due to machinery improvements.

Machines have changed greatly in the last 30 years, particularly with the incorporation of numerical control. They have gone from being mechanical machines to real mechatronic systems, where control, drives and sensorisation are key elements. This trend is unstoppable since, thanks to the combination of improvements in materials and mechanical design with control and algorithms executed by the same, better precision, greater speed and worker-friendly inter-relations have been achieved.

However, in the last 15 years an even greater change has occurred, traditional machines, i.e., lathes, milling machines, grinders, *etc.*, have evolved into multiprocess/multitask machines, some of which are capable of milling, drilling, turning, boring, hobbing, measuring and even tempering with laser in the same machine. Every year new concepts appear in this line from the classic machining centre to the turning centre, multitask machines, lathe-milling machines, turning-grinding machines, *etc.* In some cases one hears about the "factory in a machine", which means all operations are performed in the same machine. Designers have done away with many machinery stereotypes, creating designs to solve the user problems. Perhaps we could say "milling machines" are no longer manufactured but rather "machines which mill", or lathes are no longer manufactured but "machines with turning capabilities". However, we may be exaggerating since the production sector tradition and custom tends to see them as classical machine types, depending on the predominance of their functions or machine architectures, *etc.* The tradition is the tradition and metal production is a "conservative" sector.

The wide variety of machinery and options available has complicated the update of classical sources, like books. A single author is unlikely to know all the aspects, technologies or even the production conditions of each sector to write a single book. Thus, the aim of this work has been to seek the contribution of

authors specialised in different technological fields and industrial sectors. Each masters one of the technologies comprising machine tools, from control bases to structure, spindles and drives, *etc.* Furthermore, the authors of each chapter have not only had a fluid relation in the past but continue to do so today, thus enabling text coherence and a common view.

In Europe, the USA, and Japan machine tooling is a sector which has undergone a great technological evolution in recent years. In this context, important research and development projects are underway, e.g., the Integrated Project NEXT (Next generation production systems), currently in progression in Europe, or the CENIT "eee-Machine" project in Spain. Asian countries like China and Korea have joined these poles and in recent years India and Turkey too. Competition is high, not only at a technological level but also a monetary level. Two key aspects are: a) cost reduction; this might result from greater production, and b) the need to adapt machines to each customer's needs. Both aspects are contradictory, and are settled using modular design ideas, greater bindings with supplier chains, and the offer of multiple accessories on the same basic machine models.

Nevertheless, we must not lose sight of the importance of environmental impact and machines *life cycle analysis*. Consuming little electricity, reducing coolant use and eliminating electromagnetic radiations are important requirements today. The machine must be "eco-efficient", i.e., with minimum impact and maximum productivity and/or precision.

Machinery precision has also grown. In a hundred years we have gone from tenths of millimetres to below hundredths, and in some cases machines border the micron frontier.

This text is the final result of that work, which attempts to update knowledge on machine tool machine design, construction and use. It is based on the premise that the reader is already familiar with machinery in general and as such familiar with the basic books. Furthermore, it is directed at the reader seeking a source containing the advances of recent years, on display at the main sector fairs, such as the Hanover EMO, Chicago IMTS and JIMTOF. Researchers commencing their work on the machine tool and production sector may find this book useful.

Finally, the authors would like to point out they have gathered information from classical sources and directly from machines existing on the market. The machine tool is a living element with an important industry. It is impossible to generalise without mentioning the companies which invent, improve and re-design these machines. We should also like to express our gratitude to the companies willing to lend their images and ideas. Indeed one of the virtues of this book is its reference to real technology and not solely academic technology.

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