PREFACE

In the last four decades, the development in the material processing domain led to the new concept named Non-Conventional or Non-Traditional Technologies. These technologies try to solve a lot of typical problems where traditional techniques proved to be inefficient. Mainly new forming, joining, casting and machining technologies have been developed. In all the cases, simulation techniques have helped to the development of the new technologies.

So, Incremental Forming-Forging, Rapid Manufacturing and Laser Cladding, Laser Based Coating, Laser Based Joining, among others, are currently applied new developed materials processing without materials removal. However, the main researches on Non-Conventional Materials Processing Technologies have been carried out in Materials Removal Processes.

Nearly 70 years have already gone since in 1943 two married Russian scientists, Dr. Boris and Dr. Natalya Lazarenko, with the help of the young student B. Zolotych, published the first research paper in which a non-mechanical alternative to the controlled removal of part material was proposed. The work 'About the inversion of metal erosion and methods to fight ravage of electric contacts' (Moscow WEI Institute, 1943) presented the fundamentals of a method in which the thermal energy generated by a controlled electrical spark was used to effectively vaporize and melt part material. The Electrical Discharge Machining (EDM) process was born. For the first time in History it was possible to machine part material with no consideration for its mechanical properties (hardness, ductility, abrasiveness,...). Since then the proposal and growth of a new group of machining processes (the so-called Non-Traditional or Non-Conventional Machining processes) has been an answer to the extreme manufacturing requirements imposed by emerging and advanced engineering materials. The development new generations of tool steels, coated hard metals, compact materials of extreme hardness (such as polycrystalline diamond PCD and cubic boron nitride PCBN), heat resistant super alloys for the aerospace industry, etc., with very high requirements of dimensional tolerances, surface finish below Ra 0.5mm, optimum surface integrity, high productivity, reliability, etc., is a challenge that conventional machining processes cannot effectively meet.

Nowadays, the Non-Conventional Machining technologies are fully integrated in the manufacturing industry. Processes such as Abrasive Water Jet Machining (AWJM), Chemical Machining (CM), Electro Chemical Machining (ECM), the different alternatives for laser processing of materials, and of course, the already mentioned EDM, provide the industry with cost-effective solutions for the manufacturing of high-added value components for sectors such as precision tooling, aeronautics, bioengineering, etc. In this context, and taking into account the current global situation in which products and processes related to the manufacturing industry are characterized by a high rate of change, efforts leading to the updating of knowledge through R&D performed by high-level international groups are of critical importance.

The past MESIC2011 held in Cadiz (Spain) has become a consolidated forum for shearing the most recent research results in the field of Non-Conventional Materials Processing Technologies. This Volume collects some of those works, aiming to be an updated reference for the international State-of-the-Art in this field.

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