FRACTIONAL DIFFERENTIATION AND ITS APPLICATIONS

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The views and opinions expressed in all the papers of this book are the author's personal one.

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Preface

Research, which generates knowledge through innovating and original results stemming from work in quadrature with a common school of thought, can neither be decreed nor programmed.

This is also true for multi-field actions in pluridiciplinarity sense, to break through common scientific or technological walls, and even to solve common problems.

In both cases, innovation results from a complex unmodelable process which, through individual people, transcends any structuring of research and of its environment, even if this process can draw its essence and its conditioning from it through constraints and problematics, whether their nature be purely scientific, technological or industrial.

Research structuring, as described by laboratories and their scientific supervisions, often seems to be rooted in tradition. Given the importance of measuring the impact of research on a socioeconomic area, research activities are often structured like a grid, where the vertical lines represent disciplines and where the horizontal lines represent pluridisciplinary fields. Each horizontal line have in common an application domain often defined by a sector of industry (automotive, aeronautic, …). In such a case, inter-field actions are imposed by downstream research, and these actions are based on various mathematical tools and methodological approaches. However, each horizontal line can also be organized around a common point which is not an application domain. It can be a mathematical tool or a methodological approach which is so generic that it permits grouping several disciplines. Here, inter-fields actions are imposed by upstream research, and these actions are carried out in various application domains.

It is in such a context that a large number of scientific contributions were presented at the IFAC-FDA'04 workshop held in Bordeaux, France in July 2004. These three volumes entitled "Fractional differentiation and its applications" are based on these contributions.

Here, the common point is fractional differentiation, and the inter-field actions concern a variety of disciplines and application domains.

Such a situation, but also the contributors, are at the root of the international success of the workshop, and we should like to take this opportunity to thank them all. We hope that the parent organisations will be able to draw the appropriate conclusions from such a success when making decisions on structuring and directions to take on scientific research.

The three volumes are:

Volume 1 - Fractional differentiation and its applications: mathematical tools, geometrical and physical aspects;
Volume 2 - Fractional differentiation and its applications: econophysics, mechanics, material modelling, thermal systems, electronics, electrical systems;
Volume 3 - Fractional differentiation and its applications: systems analysis, implementation and simulation, systems identification and control.

These volumes contain a selection of articles from over a hundred papers presented at the IFAC-FDA'04 workshop and some extra papers. They are an overview of current research on fractional differentiation and fractional systems including as wide a range of researchers, countries, and fields as possible.

This publication is intended for graduate students and researchers in fractional derivative and fractional systems and their real world applications. It demonstrates the usefulness of fractional differentiation in practice.

The IFAC-FDA'04 workshop was an important stage in bringing together the fractional differentiation research community, and we hope these three volumes will take us further along this path.

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