

Preface

This book encompasses contributions of the second AtMol Workshop in Barcelona, January 2012. AtMol is a research project fully supported by the European Commission's ICT-FET programme. AtMol was launched on 1st January 2011 for duration of 4 years, with the objective to construct the first ever complete molecular chip. A molecular chip is a small nanomachine where common microelectronic functionalities are brought and encapsulated at the atomic scale. The core of a molecular chip will make use of the extraordinary properties of molecule(s) and surface atomic wire(s), both regarding their chemical and quantum electronic characteristics that should be of practical use and appealing to future information technologies (ITs) manufacturing. The IT technology is approaching the atomic scale and many reports on molecular devices have filled the literature in the last decade. Hence, it was time to look at the field from the broad perspective of the different possible architectures for a molecular system to perform at least an elementary Boolean logic function at the atomic scale. This is the aim of the present book and its corresponding originating workshop. In order to steer discussions and gather the main ideas and challenges arising in molecular-based ITs, the book has been divided into five sections, each section containing contributions from different groups worldwide.

Design issues are dealt within three sections of the book. These range from extension of known hybrid molecular-electronics strategies, which correspond to molecular devices for classical logic, from designs based on intramolecular quantum behaviour in a section entitled quantum controlled logic gates and a section on the nowadays standard molecular qubits. The design of the molecular-chip core is not the only challenge to be faced by future IT technologies but also the interface of the molecular-chip core with the macroscopic world. These interfaces will necessarily have to match the atom scale with the macroscopic one. In this book two sections have been devoted to the study of the circuits that should connect and interconnect the active molecule logic gates. The first section builds on the gathered know-how on molecular devices, presenting how molecule(s) themselves can be used as circuits that interconnect and do the interfacing. A second section on surface dangling bond circuits presents appealing new designs to connect the atomic world

with the macroscopic one using stable solid surfaces where atomic-size wires have been constructed through modifying electronic states with an atomic precision.

The topics reported in this book have immense potential for future IT as recognized at the European Commission level. We are happy to thank the ICT-FET programme and A*STAR of Singapore for the financial support in organizing this second workshop and Springer Verlag and its staff members for the publication of this book. We are sure that this book will become a referent and an important step towards the realization of atomic- and molecular-based technologies.

For the organizing committee

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