Preface

It is our pleasure to present this special issue of "Cybernetics and Information Technologies". In this issue (Volume 17, No 5 – December 2017), we selected 10 papers which have gone through review and revision, and represent advanced supercomputer applications efficiently deployed at the Bulgarian supercomputer Avitohol (**http: www.hpc.acad.bg**). The preliminary versions of these papers were presented at the workshop "Two years of Avitohol: Advanced High Performance Computing Applications" held on 28-31 October 2017 in the town Panagyurishte, Bulgaria.

This workshop gathered the most active users of the supercomputer Avitohol to present the recent results of their research. The workshop was organized by the Institute of Information and Communication Technologies – Bulgarian Academy of Sciences (IICT-BAS), and had more than 40 participants, among them distinguished scientists from Germany, Hungary, Macedonia, Armenia and Albania, all of them IICT-BAS collaborators in various European projects. The program included 25 presentations of High Performance Computing (HPC) applications in bioinformatics, molecular dynamics, environmental protection, climatology, digital cultural heritage, etc., divided in two main tracks: **High Performance Computing Applications,** and **Tools and Services for High Performance Computing**. A special attention was given to the presentation of current status and future perspective of the HPC in Bulgaria.

The current IICT-BAS high performance computing infrastructure, equipped with basic and applied software, databases, middleware, and services offers transparent access for Bulgarian researchers for development and use of computationally- and data-intensive scientific applications. The newest multifunctional HPC system – Avitohol, has been purchased and installed at IICT-BAS in 2015. It consists of 150 computational servers HP SL250s Gen8, equipped with two Intel Xeon E5-2650v2 CPUs and two Intel Xeon Phi 7120P

coprocessors, 64GB RAM, two 500 GB hard drives, interconnected with non-blocking FDR InfiniBand running at 56 Gbps line speed. The total number of cores is 20700 and the total RAM is 9600 GB, respectively. The servers are deployed in 4 dual racks HP MCS 200, which have water cooling and can deliver up to 50 kW of power per rack. A central rack contains most of the storage, management servers and the central communication switches. The theoretical peak performance of the system is estimated at 412.3 TFlop/s in double precision while the RMAX Performance according the LINPACK benchmark is 264.2 TFlop/s. The Avitohol HPC system has been operational since January 2016 and it is ranked on 389th place according the 46th T0P500 list.

We would like to thank all those who kindly contributed to this Special Issue: The authors who submitted their papers, reviewers for their kind help and cooperation, and the Editor-in-Chief, Professor Danail Dochev, for his support.

Aneta Karaivanova, Todor Gurov,
Guest Editors
Institute of Information and Communication Technologies,
Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria