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PREFACE

The International Symposium on Supercomputing — New Horizon of Computational Science was held on September 1-3, 1997 at the Science Museum in Tokyo, to celebrate 60-year birthday of Professor Daichiro Sugimoto, who has been leading theoretical and numerical astrophysics for 30 years.

The conference covered exceptionally wide range of subjects, to follow Sugimoto's accomplishments in many fields. On the first day we had three talks on stellar evolution and six talks on stellar dynamics. On the second day, six talks on special-purpose computing and four talks on large-scale computing in Molecular Dynamics were given. On the third and the last day, three talks on dedicated computers on Lattice QCD calculations and six talks on present and future of general-purpose HPC systems were given. In addition, some 30 posters were presented on various subjects in computational science.

In stellar evolution, D. Arnett (Univ. of Arizona) gave an excellent talk on the recent development in three-dimensional simulation of Supernova, in particular on quantitative comparison between different techniques such as grid-based methods and SPH (Smoothed Particle Hydrodynamics). Y. Kondo (NASA) discussed recent advance in the modeling of the evolution of binary stars, and I. Hachisu (Univ. of Tokyo) discussed Rayleigh-Taylor instabilities in supernovae (contribution not included).

In stellar dynamics, P. Hut (IAS) gave a superb review on the long-term evolution of stellar system, J. Makino (Univ. of Tokyo) described briefly the results obtained on GRAPE-4 special-purpose computer and the follow-up project, GRAPE-6, which is approved as of June 1997. GRAPE-6 will be completed by year 2001 with the peak speed around 200 Tflops. R. Spurzem (Rechen-Inst.) and D. Heggie (Univ. of Edinburgh) talked on recent advance in the study of star clusters, and E. Athanassoula (Marseille Observatory) described the work done using their GRAPE-3 systems. S. Ida (Tokyo Inst. of Technology) described the result of the simulation of the formation of Moon.

The first talk of the second day was given by F-H. Hsu of the IBM T.J. Watson Research center, on "Deep Blue", the special-purpose computer for Chess, which, for the first time in the history, won the match with the best human player, Mr. Gary Kasparov (unfortunately, Hsu's contribution is not included in this volume). Then A. Bakker of Delft Inst. of Technology looked back his 20 years of developing special-purpose computers for molecular dynamics and simulation of spin systems. J. Arnold gave an overview of the emerging new field of reconfigurable computing, which falls in between traditional general-purpose computers and special-purpose computers. S. Okumura (NAO) described the history of ultra-high-performance digital signal processors for radio astronomy. They have built a machine with 20 GOPS performance in early 80s, and keep improving the speed.
M. Taiji (ISM) told on general aspects of GRAPE-type systems, and T. Narumi (Univ. of Tokyo) the 100-Tflops GRAPE-type machine for MD calculations, which will be finished by 1999.

In the session of Molecular Dynamics, M. Field (Inst. de Biologie Structurale) talked on sophisticated algorithms implemented both on general-purpose computers and special-purpose MD-GRAPE system. B. Brooks of NIH and M. Guest of Daresbury Laboratory gave performance evaluation of various computer systems for MD calculations. It seems general conclusion is that loosely coupled cluster of Intel PCs offer the best price-performance. Alpha-based PCs gave comparable results. M. Klein (Univ. of Pennsylvania) discussed MD simulation of ion channels and comparison with experimental results.

Morning session of the third day was dedicated to QCD machines, which have been the driving force of the computational physicists' effort to develop massively parallel computers. R. Mawhinney of Columbia University presented the 400 Gflops QCDSP machine, Y. Iwasaki of Tsukuba University presented 600 Gflops CP-PACS, and R. Tripiccione of INFN presented the overview of APE families. Their achievement has been impressive and will be so in the future.

The topic of the final session was general-purpose supercomputing. T. Sterling of JPL/Caltech gave a fascinating view of heterogeneous general-purpose computer which combines ultrafast RSFQ Josephson-Junction processor, silicon memories with integrated processors, and holographic memory. There were also presentations from SGI/Cray, NEC, Fujitsu, Hitachi and Digital (however, we received the contribution only from Fujitsu). NEC and Fujitsu were pursuing rather traditional vector-parallel approach. Their claim was that for many real applications, high memory bandwidth of vector-parallel machines resulted in better price-performance and scalability compared to RISC-based systems. Hitachi's SR2201 (actually the commercial version of CP-PACS) was equipped with vector capability and exceptionally memory bandwidth, and Next-generation products from SGI/Cray and Digital, and certainly of other players in RISC-based systems, would have greatly improved memory hierarchy.

Being part of the GRAPE project initiated by Professor Sugimoto, We know our view is biased, but if we compare the price-performance of dedicated systems like GRAPE or QCD machines and that of general-purpose computers, no matter they are vector-parallel machines or bunch of Intel PCs, the following conclusion is inevitable: Dedicated systems offer one or two orders of magnitude better performance for the same price tag. At present, many new results in star cluster dynamics and QCD come from these dedicated machines, and more will come in the future. Whether such practice can spread to other fields like molecular dynamics was one of the main topics of the conference. We believe it will happen in a few years.

The scientific organizing committee for the symposium consisted of David Arnett, Norman Christ, Jack Dongarra, Martin J. Field, Douglas C. Heg-
gie, Piet Hut, Icko Iben Jr., Toshio Kawai, Junichiro Makino and Ken’ichi Nomoto.

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