Zentrum für Hochleistungsrechnen

TECHNISCHE
UNIVERSITÄT
DRESDEN

EINLADUNG
zum
ZHR - KOLLOQUIUM

Titel: **The Simulation of Quantum Computers**

Referent: **Priv.-Doz. Dr. Dr. Thomas Lippert**
Forschungszentrum Jülich / Zentralinstitut für Angewandte Mathematik
John von Neumann - Institut für Computing (NIC)

Kurzfassung:

Quantum computing is based on the exploitation of quantum effects to perform some important computations more efficiently than ever possible on classical computers.

Well known quantum algorithms are Shor's polynomial time factoring algorithm and Grover's data base search scheme. Their potential is due to the parallelism of a quantum computation increasing exponentially with the size of the computing device. Another promising application field is the quantum simulation of quantum systems of quantum statistical physics or quantum field theory.

IBM has succeeded in building a first working quantum computing device with up to 7 qubits based on NMR technology, however, the construction of large multi-qubit systems appears to become extremely difficult due to the loss of coherence of the quantum states.

Like the design process of modern microprocessors which is carried out by means of sophisticated software, modelling and simulation of the entire QC device is even more relevant. Simulation is required in order to understand the functioning of quantum algorithms, to construct novel quantum algorithms, to "write" quantum programs, to teach quantum computing, to construct real quantum computers, to understand and fight de-coherence and to understand and control the influence of the environment. Since quantum parallelism increases exponentially with the size of the quantum computer, parallel supercomputers are required for realistic simulations.

I intend to give an introduction to the simulation of quantum computers using conventional computers. Such simulations are based on a generic physical model of quantum computer hardware. Issues like parallel gate level simulators, modelling of QCs, simulators for physical quantum computers, and the emulation of quantum simulations for quantum systems on classical computers are addressed.

Ort: **Willers-Bau C 207**
Zeit: **Donnerstag, den 27. Mai 2004, 14.00 Uhr**

gez. Prof. Dr. Wolfgang E. Nagel