Workshop QuAASi16 on Quantum Annealing

September 6, 2016 (HE110). The „Jülich Supercomputer Centre" of the Research Centre Jülich (FZJ), Germany, organized an International Workshop on Quantum Annealing and its Applications in Science and Industry (QuAASI'16). It was held at FZJ on July 26 and 27, 2016 and was followed by the "D-Wave Exploration Day" held on July 28th at the same location.

The program of the Workshop is accessible here. It contains links to several of the invited PPT presentations[1]. This two-day workshop provided participants the opportunity to discuss the potential of quantum annealing for pure scientific and more applied purposes. The D-Wave Exploration Day allowed a limited number of selected participants to get a feeling on how to use a quantum annealer for computation. The talks covered topics including the history of quantum annealing, adiabatic quantum computation, quantum annealing algorithms for optimization problems in science and industry, and D-Wave's quantum annealing architecture.

At about the same time , *Physical Review X* published a paper by a Google group of authors claiming that for a certain class of multi-variable optimization problems, quantum annealing leads to 99% probability results in many orders of magnitude shorter time, see V.A. Denchev et al, *Physical Reviev* X **6**, 031015 (2016).

Quantum annealing is a technique, inspired by the classical simulated annealing techniques based on temperature fluctuations, for finding the global minimum of a function by a process using quantum fluctuations. It is mainly used for optimization problems having a discrete search space with many local minima. Many challenging optimization problems of this kind play a role in scientific research and in industrial applications.

D-Wave is the first company that has commercialized quantum annealers. Their quantum annealer is a programmable artificial spin system manufactured as an integrated circuit of superconducting qubits. Qubits or quantum bits are the elementary building blocks of a quantum computer, similar to the bits in a digital computer. The latest D-Wave system, D-Wave 2X, is a 1000-qubit quantum annealer.

Although discussions about whether the D-Wave machines outperform classical optimizers or not are continuing, it is clear that the availability of operational hardware allows exploring the potential of quantum annealing for a range of real-world applications as of today.

[1] These links are only temporary and may be removed by FZJ. Those interested should download the PPTs at their early convenience.