國立中央大學數學系

專題演講

主　講　人：Prof. Moody T. Chu (Department of Mathematics, North Carolina State University, USA)

演講題目：Optimal Hamiltonian Synthesis for Quantum Computing

演講茶會：2024年05月09日(星期四) 2:30 p.m. ~ 3:00 p.m.

茶會地點：中央大學鴻經館M306

演講時間：2024年05月09日(星期四) 3:00 p.m. ~ 4:00 p.m.

演講地點：中央大學鴻經館M107

Abstract：

Simulating the time evolution of a Hamiltonian system on a classical computer is hard —The computational power required to even describe a quantum system scales exponentially with the number of its constituents, let alone integrate its equations of motion. Hamiltonian simulation on a quantum machine is a possible solution to this challenge – Assuming that a quantum machine composed of spin-1⁄2 particles that we could manipulate at will, then it is tenable to engineer the interaction between those particles according to the one that is to be simulated, and thus predict the value of physical quantities by simply performing the appropriate measurements on the system. Establishing a linkage between the unitary operators described mathematically as a logic solution and the unitary operators recognizable as quantum circuits for execution is therefore essential for algorithm design and circuit implementation. Most current techniques are fallible because of truncation errors or the stagnation at local solutions. This work offers an innovative avenue by tackling the Cartan decomposition with the notion of Lax dynamics. The approach employs an eclectic mix of techniques from Lie theory, dynamical systems, linear algebra, combinatorics, and numerical ODEs. Not only that the process is numerically feasible, but also it produces a genuine unitary synthesis that is optimal in both the precision with controllable integration errors and the usage of only minimally required synthesis components. This talk aims at providing a glimpse into the theoretic and algorithmic foundations by exploiting the geometric properties of Hamiltonian subalgebras and describing a common mechanism for deriving the Lax dynamics. (Lots of examples will be given. This talk does not assume a priori knowledge on quantum computing.)

敬　請　公　告，歡　迎　參　加