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Matrix Product States (Tensor Networks) – Importance in High-Performance Contemporary Computing and an Exhaustive Overview

Abstract

Matrix Product States (MPS), a class of Tensor Networks, gave a new and alternative way to solve non-trivial problems in physics and numerical computing, such as in Density Matrix Renormalization Group (DMRG) and quantum many-body problems, and more recently in high-performance quantum computing applications, for example in molecular modeling. This talk gives an overview of MPS methods and provides an example of such a method employed in quantum mechanics.

Biography:

He is an experimental particle physicist, working in inter-disciplinary science and instrumentation for nearly a decade in the US and Middle East regions. He was trained as a particle physicist, undergoing graduate training first at the University of Manchester (UK) and then at the University of Houston, Texas (USA), working on a number of important experiments, such as ATLAS (at the Large Hadron Collider, LHC, CERN, Geneva), BTeV (at the U.S. Fermilab, Illinois USA), BNL E931 (at the U.S. Brookhaven National Laboratory, New York) and XEMPT (at the U.S. Jefferson National Laboratory (Jlab), Virginia). Following his

doctorate, he underwent post-doctoral and research faculty tenures in nuclear medicine and radiation physics/biophysics from Texas, mainly at the Texas Center for Superconductivity at UH and University of Texas MD Anderson Research Centre. After spending some time working as a visiting faculty in the U.S., Pakistan and Malaysia, he has been based at Jazan University (Department of Physics, Particle Physics group), one of the reputed public research universities in Saudi Arabia, where with the help of two competitive grants, he has initiated a small but world-class laboratory in mesoscopic physics and quantum measurements. He also continues collaborating with Jefferson National Laboratory, especially in helping build the world's new particle accelerator and collider, the Electron-Ion Collider. He has been an elected member with a number of reputed international science societies, especially the U.S. Scientific Research Society and NYAS.