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Implementing quantum gates by optimal control with doubly exponential convergence

Problems of controlling quantum phenomena in all their variants are typically treated as optimisation problems which can be tackled with general numerical optimisation techniques. At least in the cases of state preparation and gate synthesis, this formulation is derived from a root finding problem (ie. of solving a multi-dimensional equation). In the gate synthesis case, which will be the focus of this talk, the root finding approach leads to a more efficient solution algorithm - while shedding light on the behaviour of this new, and existing, numerical methods. In the state preparation case, such substantial performance gains cannot be expected, but the analogous root finding method has the interesting property of not using derivatives.

14. Februar 2012, 15:00 Uhr

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