Dynamic Phases and Robust Quantum Gates\textsuperscript{1} YASUSHI KONDO, TSUBASA ICHIKAWA, MASAMITSU BANDO, MIKIO NAKAHARA, Kinki University — We are interested in composite pulses widely employed in Nuclear Magnetic Resonance (NMR) and geometric phase gates (GQGs) with vanishing dynamic phases in Quantum Information Processing (QIP). A composite pulse in NMR is constructed with poor quality pulses but becomes more reliable than its components. We found: a composite pulse robust against pulse length error in NMR is always a GQG [1]. We then extended this observation to two-qubit operations. Let us consider the interaction \(e^{-i\theta \sigma_z \otimes \sigma_z}\) and assume that there is a systematic error in \(\theta\). When we construct a “composite pulse” robust against this error, we obtain a two-qubit GQG [2]. We clarified that geometric phase gates are really useful in QIT.


\textsuperscript{2} T. Ichikawa, M. Bando, Y. Kondo & M. Nakahara, submitted to \textit{philosophical transaction A}.

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