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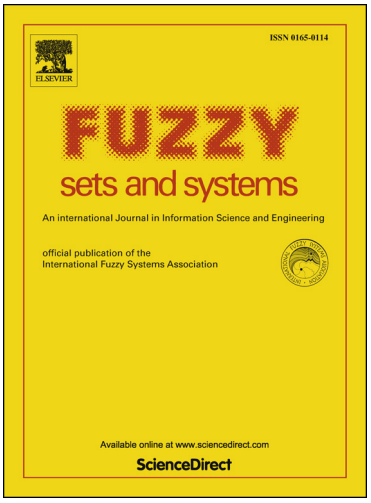

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A Many-valued Approach to Quantum Computational Logics

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Abstract

Quantum computational logics are special examples of quantum logic where formulas are supposed to denote pieces of quantum information (qubit-systems or mixtures of qubit-systems), while logical connectives are interpreted as reversible quantum logical gates. Hence, any formula of the quantum computational language represents a synthetic logical description of a quantum circuit. We investigate a many-valued approach to quantum information, where the basic notion of *qubit* has been replaced by the more general notion of *qudit*. The qudit-semantics allows us to represent as reversible gates some basic logical operations of Łukasiewicz many-valued logics. In the final part of the article we discuss some problems that concern possible implementations of gates by means of optical devices.

Keywords: Quantum logics, quantum tomography, logical gates.

1. Introduction

The mathematical formalism of quantum theory has inspired the development of different forms of non-classical logics, called *quantum logics*. In

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