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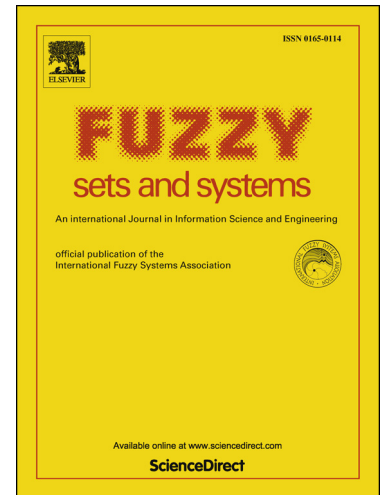
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A Many-valued Approach to Quantum Computational Logics

M.L. Dalla Chiara^a, R. Giuntini, G. Sergioli^b, R. Leporini^{c,*}

^a*Dipartimento di Lettere e Filosofia,
Università di Firenze, via Bolognese 52, I-50139 Firenze, Italy.*

^b*Dipartimento di Pedagogia, Psicologia, Filosofia,
Università di Cagliari, via Is Mirrionis 1, I-09123 Cagliari, Italy.*

^c*Dipartimento di Ingegneria Gestionale, dell'Informazione e della Produzione,
Università di Bergamo, viale Marconi 5, I-24044 Dalmine (BG), Italy.*

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 We investigate a many-valued approach to quantum information, where the basic notion of *qubit* has been replaced by the more general notion of *qudit*.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

*Corresponding author

Email addresses: dallachiara@unifi.it (M.L. Dalla Chiara),
giuntini@unica.it, giuseppe.sergioli@gmail.com (R. Giuntini, G. Sergioli),
roberto.leporini@unibg.it (R. Leporini)

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