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Cubic Operators Corresponding to Graphs

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Abstract: We introduce a notion of a cubic stochastic operator corresponding to graph. We prove that each such operator has a unique fixed point. Besides, it is shown that any trajectory of such cubic stochastic operator exponentially rapidly converges to this fixed point.

Keywords: *quadratic stochastic operator; cubic stochastic operator; Volterra and non-Volterra operators.*

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1 Introduction

The history of quadratic stochastic operator (QSO) can be traced to Bernshtein's work [1]. Since then the theory of QSOs has been further developed motivated by their frequent occurrence in several problems of physical, economical and biological systems, where QSOs serve as a tool for the study of dynamical properties and modeling, see [2,4–12,15, 19–23]. While they were originally introduced as "evolutionary operators" to describe the dynamics of gene frequencies for given laws of heredity in mathematical population genetics, QSOs and the dynamical systems they describe have become interesting objects of study in their own right from a purely mathematical point of view. For a recent review on the theory of quadratic operators see [7].

In modern scientific investigations non-linear operators of higher order arise. Nowadays another class of nonlinear operators which are different from QSOs arises. In particular, *cubic stochastic operator* (CSO) can be obtained in gene engineering and free population with ternary production. In paper [17] the concept of *cubic stochastic operator* was introduced.

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