

## Research Article

# A Discrete Equivalent of the Logistic Equation

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A discrete equivalent and not analogue of the well-known logistic differential equation is proposed. This discrete equivalent logistic equation is of the Volterra convolution type, is obtained by use of a functional-analytic method, and is explicitly solved using the z-transform method. The connection of the solution of the discrete equivalent logistic equation with the solution of the logistic differential equation is discussed. Also, some differences of the discrete equivalent logistic equation and the well-known discrete analogue of the logistic equation are mentioned. It is hoped that this discrete equivalent of the logistic equation could be a better choice for the modelling of various problems, where different versions of known discrete logistic equations are used until nowadays.

## 1. Introduction

The well-known logistic differential equation was originally proposed by the Belgian mathematician Pierre-François Verhulst (1804–1849) in 1838, in order to describe the growth of a population  $P(t)$  under the assumptions that the rate of growth of the population was proportional to

- (A1) the existing population and
- (A2) the amount of available resources.

When this problem is “translated” into mathematics, results to the differential equation

$$\frac{dP(t)}{dt} = rP(t) \left[ 1 - \frac{P(t)}{K} \right], \quad P(0) = P_0, \quad (1.1)$$