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SOLVABLE SYSTEMS OF NONLINEAR PARTIAL DIFFERENCE EQUATIONS

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Abstract. In this paper we give the closed form expressions of some two dimensional systems of nonlinear rational partial difference equations of second order.We shall use a new method to prove the results by using (odd-even) double mathematical induction. As a direct consequences , we investigate and drive the explicit solutions of some partial difference equations and some (systems of) ordinary difference equations .
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Keywords. closed form expressions,(partial)difference equations, solutions , double mathematical induction,two dimensional systems.

AMS (MOS) subject classification: 39A10, 39A14.

1 Introduction

While the study of (ordinary)difference equations has been widely treated in the past,partial difference equations(PΔEs)have not received the same full attention.Both of ordinary and partial difference equations may be found in the study of probability ,dynamics and other branches of mathematical physics .Moreover,partial difference equations arise in applications involving population dynamics with spatial migrations , chemical reactions and finite difference schemes . Indeed Laplace and Lagrange considered the solution of partial difference equations in their studies of dynamics and probability.
An example of a partial difference equation is the following well known relation

$$C_m^{(n)} = C_{m-1}^{(n-1)} + C_m^{(n-1)} \quad , 1 \leq m < n.$$

The solution of this equation is the celebrated binomial coefficient func-