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SOME RESULTS ON DIFFERENTIAL-DIFFERENCE PAINLEVÉ EQUATIONS

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Abstract. This paper studies the properties of finite order transcendental meromorphic solutions to certain differential-difference Painlevé III equations. Also discussed the exponent of convergence of poles of divided difference $\Delta f/f$, existence of "Borel exceptional value" and rational solutions.

1. Introduction

A meromorphic function is defined in this paper for the entire complex plane $\mathbb{C}$. Standard notations can be found in [2, 5, 12] as well as the fundamentals of Nevanlinna theory. Let $\mathcal{F} = \{f : f\ is\ finite-order\ transcendental\ meromorphic\ function\ in\ \mathbb{C}\}$. For $\beta \in \mathcal{F}$, the term "small function" of f means if $T(r,\beta) = S(r,f)$. Also, $S(r,f)$ denotes any quantity that can satisfy $S(r,f) = o(T(r,f)),\ r \notin E,\ r \to \infty$.

If all the solutions of ordinary differential equations are single-valued around all removable singularities,they possess Painlevé property (for more details see[11]). In 1895-1900, Painlevé [9], Fuchs [6] and Gambier [1] worked on second order differential equations with an interpretation of Painlevé property, proposed by Picard. Painlevé and his colleagues established six non-linear differential equations, which cannot be solved using known functions, are called Painlevé equations. In physics as well as mathematics, Painlevé equations play vital role due to their applications of plasma physics, non-linear optics and solid state physics etc.

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