Polynomial quasisolutions method for some linear differential difference equations of mixed type

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The paper considers a scalar linear differential difference equation (LDDE) of mixed type

$$(*) \qquad \dot{x}(t) = (a_0 + a_1 t)x(t) + (b_0 + b_1 t)x(t-1) + (d_0 + d_1 t)x(t+1) + \bar{f}(t),\ t \in R,$$

where $\bar{f}(t) = \sum_{n=0}^{F} \bar{f}_n t^n$. This equation is investigated with the use of the method of polynomial quasisolutions [1], [2] based on the representation of an unknown function in the form of polynomial $x(t) = \sum_{n=0}^{N} x_n t^n$. As a result of substitution of this function into equation $(*)$, there appears a residual $\Delta(t) = O(t^N)$, for which an exact analytical representation has been obtained. In turn, this allows one to find the unknown coefficients x_n and consequently the polynomial quasisolution $x(t)$.

Several examples are considered.

References

[1] *V. B. Cherepennikov, P. G. Ermolaeva*: Polynomial quasisolutions of linear differential-difference equations. Opusc. Math. *26* (2006), 431–443.

[2] *V. B. Cherepennikov, P. G. Ermolaeva*: Smooth solutions of an initial value problem for some differential difference equations. Sib. Zh. Vychisl. Mat. *13* (2010), 213–226; translation in Numer. Analysis Appl. *3* (2010), 174–185.