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ABSTRACT

TRANSFORMATION OF ORDINARY DIFFERENTIAL EQUATIONS INTO AN UNIVERSAL FORM WITH SPACE EXTENSION, AND, ITS TRUNCATING APPROXIMATIONS

Sevda ÜSKÜPLÜ ALTINBAŞAK

In this thesis, it is focused on the conversion of matrix ordinary differential equations to certain universal forms which can be handled more easily than their original structures. Conversion to new form is realized by using space extension approach which introduces new unknowns into equation. First, the differential equation is converted into a new universal form by using space extension approach. Then a series solution to this common form is sought. The coefficients of this solution form a two term recursion. Main purpose of this work is to construct approximate solutions by truncating this series solution. This method presented here is empowered by using perturbation expansions at the other end point of the interval under consideration. A perturbation parameter is introduced into the matrix ordinary differential equation and the equation is expanded into Maclaurin series whose coefficients satisfy a two term recursion and thus a new truncation approximation is constructed. We also investigated the convergence and error estimates for these truncation approximants. The nonlinear matrix ordinary differential equations are also concerned in the thesis. First, fluctuation free approximation is used in order to obtain nonlinear matrix ordinary differential via certain partial differential equations. Then, space extension concept is applied to partial differential equations. This is a very important fact that we obtain a system of nonlinear ordinary differential equations by using partial differential equations. This prevents us from solving nonlinear ODEs. We get a solution for them by solving related PDEs via space extension approach.

Keywords: Ordinary Differential Equations, space extension, fluctuation expansion, Okubo Form

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