EXISTENCE, UNIQUENESS AND APPROXIMATION FOR THE SOLUTION OF A SECOND ORDER NEUTRAL DIFFERENTIAL EQUATION WITH DELAY IN BANACH SPACES

ALEXANDRU MIHAI BICA and RĂZVAN GABOR

Abstract. In order to obtain the existence, uniqueness and approximation of the solution of the initial value problem, associated to second order neutral differential equation in Banach spaces, Perov's fixed point theorem is used. The associated numerical method use the sequence of successive approximations and a recent trapezoidal type inequality for Lipschitzian functions with values in Banach space.

MSC 2000. 34K30.

Key words. Second order delayed neutral differential equations, Perov's fixed point theorem, successive approximations, trapezoidal type inequality.

REFERENCES

[1] ANDRAS, SZ., *A note on Perov's fixed point theory*, Fixed Point Theory, **4** (1) (2003), 105–108.

[2] AKCA, H., ARSLAN, G., MICULA, GH., *Deficient spline approximations for second order neutral differential equations,* Studia Univ. Babeş-Bolyai Math., **40** (4) (1995), 85–97.

[3] BERNFELD, S.R., LAKSMIKANTHAM, V., *An introduction to nonlinear boundary value problems*, Acad. Press New York, 1974.

[4] BICA, A.M., *A new point of view to approach first order neutral delay differential equations,* Internat. J. of Evol. Eq., **1** (4) (2005), 1–19.

[5] BICA, A.M., MURESAN, S., *New point of view to approach Volterra integro-differential equations*, Fixed Point Theory (submited).

[6] BUSE, C., DRAGOMIR, S.S., ROUMELIOTIS, J., SOFO, A., *Generalized trapezoid type inequalities for vector valued functions and applications,* Math. Inequal. Appl., **5** (3) (2002), 435–450.

[7] DEZSÖ, G., *Fixed point theorems in generalized metric space*, Pure Math. Appl., **11** (2) (2000), 183–186.

[8] DHAGE, B.C., *Existence and uniqueness theorems for nonlinear boundary value problems with deviating arguments,* Analele Ştiinţifice ale Universităţii "AL. I. CUZA" Iaşi, Matematică, Tomul **L** (f.2) (2004).

[9] MICULA, GH., EAIRWEATHER, G., *Spline approximations for second order neutral delay differential equations,* Studia Univ. Babeş-Bolyai Math., **38** (1) (1993), 87–97.

[10] PEROV, A.I., KIBENKO, A.V., *On a general method to study the boundary value problems*, Iz. Acad. Nauk., (1966), 249–264.

[11] RUS, I. A., *Principles and applications of the fixed point theory*, Ed. Dacia Cluj-Napoca, 1979 (in Romanian).

[12] RUS, I. A., *Fiber Picard operators on generalized metric spaces and applications,* Scripta Sci. Math., **1** (2) (1999), 355–363.

[13] RUS, I. A., *A fiber generalized contraction theorem and applications*, Mathematica, **41** (1) (1999), 85–90.

Department of Mathematics and Informatics
University of Oradea
Str. Universităţii nr.1
410087 Oradea, Romania
E-mail: `abica@uoradea.ro`

Liceul Pedagogic "Samuil Vulcan"
Str. Jean Calvin nr.3
Oradea, Romania
E-mail: `rgabor@rdsor.ro`