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Existence and Uniqueness of Solutions to Quasilinear Integro-differential Equations by the Method of Lines

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Abstract: In this work we consider a class of quasilinear integro-differential equations. We apply the method of lines to establish the wellposedness for a strong solution. The method of lines is a powerful tool for proving the existence and uniqueness of solutions to evolution equations. This method is oriented towards the numerical approximations.

Keywords: *method of lines; integro-differential equation; semigroups; contractions; strong solution.*

Mathematics Subject Classification (2000): 34K30, 34G20, 47H06.

1 Introduction

Let X and Y be two real reflexive Banach spaces such that Y is densely and compactly embedded in X. In the present analysis we are concerned with the following quasilinear integro-differential equation

$$\begin{cases} \frac{du}{dt}(t) + A(t,u(t))u(t) = \int_0^t k(t,s)A(s,u(s))u(s)ds + f(t,u_t), \ 0 < t \leq T, \\ u_0 = \phi \in C([-T,0],X), \end{cases} \tag{1}$$

where $A(t,u)$ is a linear operator in X, depending on t and u, defined on an open subset W of Y. We denote by $J=[0,T]$, k is a real valued function defined on $J \times J \to \mathbb{R}$ and f is defined from $J \times C([-T,0],X)$ into Y. Here $C([a,b],Z)$, for $-\infty \leq a \leq b < \infty$, is the

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