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CONVERGENCE OF SOLUTIONS OF IMPLICIT DIFFERENTIAL EQUATIONS

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Dedicated to the memory of Peter Hess

Abstract. We study convergence of solutions to implicit differential equations of the type $d(B_n y)/dt + A_n y = f_n(t)$ in a Banach space, where $\{B_n\}$, $\{A_n\}$ are two families of operators convergent in the sense of graph. We consider both a class of nonlinear operators and linear operators A_n, B_n. Examples of applications to initial boundary value problems for partial differential equations are also given.

1. Introduction. Here we are concerned with the convergence of solutions of the implicit differential equations

$$\frac{d}{dt}(B_n y)(t) + A_n y(t) \ni f_n(t), \text{ in } [0, T], \tag{1.1}$$

$$(B_n y)(0) = z_0^n, \tag{1.2}$$

where $\{B_n\}$, $\{A_n\}$ are two families of operators in a Banach space convergent in the sense of graph to B and A, respectively. This problem is studied here for a class of nonlinear subpotential operators A_n, B_n in Section 2 and for linear operators in Section 3.

The convergence results are relevant for the study of homogenization problems associated with degenerate parabolic equations as well as for optimal control problems and the convergence of finite elements schemes connected with system (1.1). (See, a.c., Attouch [2], Bensoussan, Lions and Papanicolaou [8]). Some examples of application are given below.

For other literature on Trotter-Kato convergence results for implicit differential equations we refer to Xu [23], where the theory of maximal monotone operators is used; and to Lamm and Rosen [18], relative to the linear case, where one can also

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