# 81. *A Note on Quasilinear Evolution Equations. II*

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§ 1. **Introduction.** In this note we prove local existence and analyticity in $t$ of solutions to quasilinear evolution equations

$$du/dt+A(t,u)u=f(t,u),\qquad 0<t\leqq T, \tag{1.1}$$

$$u(0)=u_0. \tag{1.2}$$

The unknown, $u$, is a function of $t$ with values in a Banach space $X$. For fixed $t$ and $v\in X$, the linear operator $-A(t,v)$ is the generator of an analytic semigroup in $X$ and $f(t,v)\in X$.

We consider the equation (1.1) under the assumptions that the domain $D(A(t,v)^h)$ of $A(t,v)^h$ is independent of $t$, $v$ for some $h>0$ and $A(t,A_0^{-\alpha}v)^h$ is the Hölder-continuous in $v$ in the sense that

$$\|A(t,A_0^{-\alpha}v)^hA(t,A_0^{-\alpha}w)^{-h}-I\|\leqq C|v-w|^\eta,$$

while in the previous paper [1] we discussed it in the case that $A(t,A_0^{-\alpha}v)^h$ is the Lipschitz-continuous.

We use the same notations as in [1].

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§ 2. **Assumptions.** We first define $a\in X$. We shall make the following assumptions:

a-1) There exist $h=1/m$, where $m$ is an integer, $m\geqq 2$, and $0\leqq\alpha<h/2$ such that $A_0^{-\alpha}$ is a well-defined bounded linear operator from $X$ to $X$ and $u_0\in D(A_0^{1+\alpha})$ where $A_0\equiv A(0,u_0)$.

a-2) There exists $T_0>0$, such that $A_{u_0}(t)\equiv A(t,u_0)$ is a well-defined operator from $X$ to $X$ for each $t\in[0,T_0)$.

a-3) For any $t\in[0,T_0)$ the resolvent of $A_{u_0}(t)$ contains the left half-plane and there exists $C_1$ such that $\|(\lambda-A_{u_0}(t))^{-1}\|\leqq C_1(1+|\lambda|)^{-1}$, $\mathrm{Re}\,\lambda\leqq 0$, and the domain, $D(A_{u_0}(t))$, of $A_{u_0}(t)$ is dense in $X$.

a-4) The domain $D(A_{u_0}(t)^h)=D$ of $A_{u_0}(t)^h$ is independent of $t\in[0,T_0)$ and there exist $C_2$, $C_3$, $\sigma$, $1-h+\alpha<\sigma\leqq 1$ such that

$$\|A_{u_0}(t)^hA_{u_0}(s)^{-h}\|\leqq C_2\qquad t,s\in[0,T_0),$$

$$\|A_{u_0}(t)^hA_{u_0}(s)^{-h}-I\|\leqq C_3|t-s|^\sigma\qquad t,s\in[0,T_0).$$

a-5) $f_{u_0}(t)\equiv f(t,u_0)$ is defined and belongs to $X$ for each $t\in[0,T_0)$, $f_{u_0}(0)\in D(A^h)$ and there exists $C_4$ such that

$$\|f_{u_0}(t)-f_{u_0}(s)\|\leqq C_4|t-s|^\sigma\qquad t,s\in[0,T_0).$$

These constants $C_i(i=1,2,3,4)$ do not depend on $t$, $s$. Then we can apply Kato's results [3]. It follows from Kato's theorem that