Meeting: 1005, Newark, Delaware, SS 4A, Special Session on Asymptotic Behavior of Evolution Equations

1005-34-114 **Dialla Konate*** (dkonate@vt.edu), 1001 Bobwhite Drive, Blacksburg, VA 24060. *Asymptotic analysis of coupled singularly perturbed abstract evolution equations in Banach spaces*

In a nuclear reactor a particle collision phenomenon may be the combination of a "slow" thermal absorption of neutrons and a "fast" fission of nucleus. From a mathematical point of view, this phenomenon is described by a system of coupled singularly perturbed equations. More precisely, consider ϵ a given small parameter such that $\epsilon \ll 1$. $\mathbf{X}$ is a Banach space. $A(t)$ is a time-dependent linear operator on $\mathbf{X}$ with domain $\mathcal{D}(A)$ independent of t; $\mathcal{D}(A)$ is a dense subset of $\mathbf{X}$. We consider three time-dependent linear operators in $\mathbf{X}$ that are $B(t)$, $P(t)$, $Q(t)$ which together with the previous operator $A(t)$ allow to construct the following linear operators:

$$\begin{cases} L_{1,\epsilon}(x(t),y(t)) = \epsilon\partial_t x(t) - Ax(t) - Py(t) \\ L_{2,\epsilon}(x(t),y(t)) = \partial_t y(t) - Qx(t) - By(t). \end{cases}$$

Consider $\mu_1 \in \mathcal{D}(A) \subset \mathbf{X}$; $\mu_2 \in \mathbf{X}$. Two "convenient" functions, say f and g being given, we consider the following coupled system of evolution equations:

$$\begin{cases} L_{1,\epsilon}(x(t),y(t)) = f(t) \\ L_{2,\epsilon}(x(t),y(t)) = r(t) \\ x(0) = \mu_1 \quad y(0) = \mu_2 \quad t \in]0,T[\end{cases} \tag{1.1}$$

The objective of the current paper is the asymptotic analysis of problem (1.1), specifically the construction of an asymptotic approximation to its solution. Some authors have shown that the solution of problem (1.1) can be approximated with a sum of two asymptotic expansions rather than three or four as previously known. These two asymptotic expansions

are such that one is valid “far away” from the initial layer (the outer expansion) and the second one is valid into it (the inner expansion). Such a result is very well-established in singular perturbation theory, but it is also known that the inner expansion is not easy to handle.

The goal of the current paper is to show that, making use of the concept of corrector, one can construct an asymptotic approximation solution to problem (1.1) of any prescribed order. The corrector is shown to be a special boundary layer function based on the stretched variable t/ϵ.

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