LINEARIZED STABILITY FOR NONLINEAR EVOLUTION EQUATIONS

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In the context of the nonlinear evolution equation $\dot{u}(t) + Bu(t) = F(u(t))$, $u(0) = u_0$, (with $B : D(B) \subset X \to X$ linear, X Banach), assuming the existence of an equilibrium solution $u_e \in X$ at which the nonlinearity $F : D(F) \subset X \to X$ has a Fréchet derivative $F'[u_e] \in B(X)$, we consider the problem of how stability properties of u_e for the nonlinear equation can be deduced from stability properties of the linearized equation $\dot{v}(t)+Bv(t) = F'[u_e]v(t)$.

We present a new concept of '*differentiating an accretive operator* $A \subset X \times X$' (possibly multivalued), and an associated abstract linearization principle that will allow for a unified treatment of this question as well as of corresponding ones for initial-history problems, age-dependent population models, and nonlinear Volterra equations.