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Algebraic-Delay Differential Systems: Age Structured Population Modeling and C^0 -Extendable Submanifolds

Consider a population of individuals occupying some habitat, which is structured by age. Suppose there are two distinct and non-competing life stages, the immature stage and the mature stage. A natural question is "What determines the age of maturity?". In many biological contexts, the age of maturity is determined by whether or not the resource concentration density, which depends on the immature population, reaches a prescribed threshold. Mathematically, this situation takes the form of a first order nonlinear transport equation coupled to an algebraic-delay term. This system gives rise to a solution semiflow, and in this talk we discuss the problem of the differentiability of this semiflow with respect to initial data. The main challenge is finding the right phase space and the right type of differentiability to recover the desired result. This is joint work with Jianhong Wu and Yuming Chen.