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Section:

9. Ordinary Differential Equations and Dynamical Systems

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Anichini, Giuseppe, Dipartimento di Matematica - Università di Modena, Italy. Conti Giuseppe, Istituto di Matematica - Facoltà di Architettura Università di Firemze, Italy

Boundary value problems for implicit ODE's in a singular case

An existence result for boundary value problems for a first order linear (system of) differential equations like $x' = A(t)x + g(t, x, x')$, with a nonlinear perturbation depending on the derivative, is sought. The boundary condition we are dealing with will be in the form $Mx(t_1) + Nx(t_2) = r \in R^n$ where M and N are constant $n \times n$ real matrices. If $U(t, s)$ is the so called evolution matrix related to the homogeneous linear differential equation associated to the given one, then the assumption $ker[M + NU(t_2, t_1)] \neq 0$, together some other technical conditions, is considered in order to get the existence result. The main tools we are using are some properties of the generalized inverse of a matrix and a fixed point theorem for set-valued maps which is a generalizations of the Darbo's theorem.