

ALGEBRAIC TOOLS FOR ANALYSIS OF INPUT-OUTPUT
EQUATIONS ON HOMOGENEOUS TIME SCALES AND ITS
APPLICATIONS FOR SOLVING SOME CONTROL
PROBLEMS

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The mathematical formalism that allows to study nonlinear control systems on homogeneous time scales is developed. This class of systems consists of continuous-time systems and systems with uniformly sampled time (discrete-time systems), so the formalism unifies the existing theories for continuous- and discrete-time systems. The field of meromorphic functions, corresponding to a given nonlinear input-output equation, is introduced. The algebraic formalism of differential one-forms over this field can be applied to study some control problems like, for example, irreducibility and realizability of nonlinear control systems. The necessary and sufficient conditions for the existence of an observable state-space realization and for irreducibility of the nonlinear i/o equation on homogeneous time scales are given. The conditions for the realizability are formulated in terms of integrability of certain subspaces of one-forms, while the conditions for irreducibility are given both in terms of subspaces of one-forms and in terms of the common left factor of two differential polynomials describing the behaviour of the system.