Extension of the concept of transfer function to discrete-time nonlinear control systems

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Abstract— In this paper the notion of transfer function of discrete-time nonlinear control system is defined. The definition is based on a non-commutative skew polynomial ring which can be by Ore condition extended into its quotient ring (field of fractions). Some properties of the transfer function, related to accessibility and observability of the system, are studied and the transfer functions of different composite systems (series, parallel and feedback connections) are given. The resulting theory is, in principle, similar to that in the linear case, except that the polynomial description relates now the differentials of inputs and outputs, and the resulting polynomial ring is non-commutative.

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