ALGEBRAIC METHODS FOR THE CONSTRUCTION OF ALGEBRAIC-DIFFERENCE EQUATIONS WITH DESIRED BEHAVIOR*  

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Abstract. For a given system of algebraic and difference equations, written as an Auto-Regressive (AR) representation $A(\sigma)\beta(k) = 0$, where $\sigma$ denotes the shift forward operator and $A(\sigma)$ a regular polynomial matrix, the forward-backward behavior of this system can be constructed by using the finite and infinite elementary divisor structure of $A(\sigma)$. This work studies the inverse problem: Given a specific forward-backward behavior, find a family of regular or non-regular polynomial matrices $A(\sigma)$, such that the constructed system $A(\sigma)\beta(k) = 0$ has exactly the prescribed behavior. It is proved that this problem can be reduced either to a linear system of equations problem or to an interpolation problem and an algorithm is proposed for constructing a system satisfying a given forward and/or backward behavior.

Key words. Algebraic-difference equation, Behavior, Exact modeling, Auto-regressive representation, Discrete time system, Higher order system, descriptor system.

AMS subject classifications. 93A30, 93C55, 93C05, 93C35, 39A05, 15A29, 15A30.

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*Received by the editors on September 26, 2016. Accepted for publication on December 9, 2017. Handling Editor: Michael Tsatsomeros. Corresponding Author: Nicholas P. Karampetakis.

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