MR3289927 93B15 34A09 34K37 93C05 93C70
Kaczorek, Tadeusz (PL-TUBEE)
★**Realization problem for descriptor positive fractional continuous-time linear systems. (English summary)**
Advances in the theory and applications of non-integer order systems, 3–14, *Lect. Notes Electr. Eng.*, 257, *Springer, Cham*, 2013.

The paper deals with the descriptor continuous-time linear system

$$E\frac{d^\alpha x(t)}{dt^\alpha} = Ax(t) + Bu(t),$$
$$y(t) = Cx(t),$$

where d^α/dt^α denotes the Caputo fractional derivative of order $\alpha \le 1$ (there is a misprint in the definition of this derivative given in the paper). The matrix E is singular, but $\det[\lambda E - A] \neq 0$ for some complex λ. The transfer matrix of the system, $T(\lambda) = C[\lambda E - A]^{-1}B$, may be decomposed as $T(\lambda) = T_{\rm sp}(\lambda) + P(\lambda)$, where $T_{\rm sp}(\lambda)$ is strictly proper and $P(\lambda)$ is polynomial. The author studies a positive realization problem. For a given transfer matrix $T(\lambda)$ he wants to find a positive descriptor continuous-time linear system whose transfer matrix coincides with $T(\lambda)$. A descriptor fractional system is positive if for any consistent nonnegative initial condition x_0 and for any control u whose fractional derivatives of order $k\alpha$, $k = 0, \ldots, \deg P(\lambda)$, are nonnegative, the state $x(t)$ and the output $y(t)$ are nonnegative for $t \ge 0$. The main result of the paper states necessary and sufficient conditions of positive realizability of $T(\lambda)$. If they are satisfied, then the realization may be easily written down as the author provides a construction of a realization.

{For the collection containing this paper see MR3289444}

Zbigniew Bartosiewicz

MR3113545 39A13 93C05 93C55
Kaczorek, Tadeusz (PL-TUBEE)
Descriptor fractional linear systems with regular pencils. (English summary)
Int. J. Appl. Math. Comput. Sci. **23** (2013), *no. 2,* 309–315.

Summary: "Methods for finding solutions of the state equations of descriptor fractional discrete-time and continuous-time linear systems with regular pencils are proposed. The derivation of the solution formulas is based on the application of the $\mathcal{Z}$ transform, the Laplace transform and the convolution theorems. Procedures for computation of the transition matrices are proposed. The efficiency of the proposed methods is

demonstrated on simple numerical examples."

MR3109405 93C05 34A08

Xu, Dengguo [Xu, Deng Guo] (PRC-CXNU); **Chen, Jing** (PRC-CXNU)

On the regularity for descriptor linear system with fractional order. (English summary)

Int. J. Appl. Math. Stat. **46** (2013), *no. 16,* 314–323.

In this article, the authors investigate the regularity of fractional-order descriptor linear systems. Also, they introduce the definition of regularity for these new systems and derive necessary and sufficient conditions for regularity. Then they obtain an equivalence relation between regularity of fractional-order descriptor linear systems and regularity of standard (integer) descriptor linear systems. The results obtained will be useful in the analysis and synthesis of this class of systems. *Velusamy Kavitha*

MR3086469 93A10 15A09 39A10

Kaczorek, Tadeusz (PL-TUBEE)

Application of the Drazin inverse to the analysis of descriptor fractional discrete-time linear systems with regular pencils. (English summary)

Int. J. Appl. Math. Comput. Sci. **23** (2013), *no. 1,* 29–33.

Summary: "The Drazin inverse of matrices is applied to find the solutions of the state equations of descriptor fractional discrete-time systems with regular pencils. An equality defining the set of admissible initial conditions for given inputs is derived. The proposed method is illustrated by a numerical example."

MR3081332 93B17 26A33 94C05

Kaczorek, Tadeusz (PL-TUBEE)

Descriptor fractional linear systems with regular pencils. (English summary)

Asian J. Control **15** (2013), *no. 4,* 1051–1064.

The paper gives an extensive analysis of descriptor linear systems of fractional order and with regular pencils. Some emphasis is placed on the applicability of such systems in modelling electrical circuits with fractional capacitors and inductors. These fractional capacitors and inductors are referred to as supercondensators and supercoils by the author. The paper suggests that any electrical circuit with singular loops, i.e. loops containing only fractional capacitive or fractional inductive elements, must be considered as a fractional descriptor system.

Both continuous- and discrete-time cases are discussed in the paper. Weierstrass regular pencil decomposition is utilized in both cases, while the Laplace transform is used in the continuous-time case.

The paper is interesting and clearly written, with several examples illustrating the theoretical considerations presented. The text is accessible even to those without prior knowledge of descriptor systems, which is, in my opinion, an additional positive quality of the paper. *Milan Rade Rapaić*

MR3049245 93D21 34A08

N'Doye, Ibrahima (LUX-ULUX3TC); **Darouach, Mohamed** (F-LOR3-CRA); **Zasadzinski, Michel** (F-LOR3-CRA); **Radhy, Nour-Eddine** (MRC-HASA-PMT)

Robust stabilization of uncertain descriptor fractional-order systems. (English summary)

Automatica J. IFAC **49** (2013), *no. 6,* 1907–1913.

Summary: "This paper presents sufficient conditions for the robust asymptotical stabilization of uncertain descriptor fractional-order systems with the fractional order α satisfying $0 < \alpha < 2$. The results are obtained in terms of linear matrix inequalities. The parameter uncertainties are assumed to be time-invariant and norm-bounded appearing in the state matrix. A necessary and sufficient condition for the normalization of uncertain descriptor fractional-order systems is given via linear matrix inequality (LMI) formulation. The state feedback control to robustly stabilize such uncertain descriptor fractional-order systems with the fractional order α belonging to $0 < \alpha < 2$ is derived. Two numerical examples are given to demonstrate the applicability of the proposed approach."

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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

MR3011841 93D20 34K20 34K36 93B36

Kchaou, Mourad (TN-SFAXEG-EE); **Souissi, Mansour** (TN-SFAX-ES); **Toumi, Ahmed** (TN-SFAXEG-EE)

Delay-dependent stability and robust $L_2 - L_\infty$ control for a class of fuzzy descriptor systems with time-varying delay. (English summary)

Internat. J. Robust Nonlinear Control **23** (2013), *no. 3,* 284–304.

Summary: "In this paper, the problem of delay-dependent robust $L_2 - L_\infty$ (energy to peak) control for a class of uncertain fuzzy descriptor systems with time-varying delay is investigated. The parametric uncertainties are assumed to be of a linear fractional form involving all system matrices. First, a delay-dependent criterion is given in terms of LMIs to guarantee that the fuzzy descriptor system is regular, impulse free, and stable. Based on this criterion, a state fuzzy feedback controller is designed to ensure that the closed-loop system is regular, impulse free, and robustly stable with a prescribed $L_2 - L_\infty$ performance satisfied for all admissible parameter uncertainties. Numerical

examples are given to show the effectiveness of the proposed approach.”

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Mathematical Reviews

Citations	From References: 0	From Reviews: 0

MR3088446 93B15 34A08 93D20
Kaczorek, Tadeusz (PL-BLYEE)
Positive stable realizations for fractional descriptor continuous-time linear systems. (English summary)
Arch. Control Sci. **22(58)** (2012), *no. 3,* 303–313.

Summary: “A method for computation of positive asymptotically stable realizations of fractional descriptor continuous-time linear systems with regular pencil is proposed. The method is based on the decomposition of the improper transfer matrix into strictly proper matrix and a polynomial matrix. A procedure for decomposition of a positive asymptotically stable realization is given and illustrated by a numerical example.”

AMERICAN MATHEMATICAL SOCIETY
MathSciNet
Mathematical Reviews

Citations	From References: 3	From Reviews: 0

MR2779698 (2011m:82075) 82D25
Eon, Jean-Guillaume (BR-FRJ-IK)
Euclidian embeddings of periodic nets: definition of a topologically induced complete set of geometric descriptors for crystal structures. (English summary)
Acta Crystallogr. Sect. A **67** (2011), *no. 1,* 68–86.

Summary: “Crystal-structure topologies, represented by periodic nets, are described by labelled quotient graphs (or voltage graphs). Because the edge space of a finite graph is the direct sum of its cycle and co-cycle spaces, a Euclidian representation of the derived periodic net is provided by mapping a basis of the cycle and co-cycle spaces to a set of real vectors. The mapping is consistent if every cycle of the basis is mapped on its own net voltage. The sum of all outgoing edges at every vertex may be chosen as a generating set of the co-cycle space. The embedding maps the cycle space onto the lattice L. By analogy, the concept of the *co-lattice* L^* is defined as the image of the generators of the co-cycle space; a co-lattice vector is proportional to the distance vector between an atom and the centre of gravity of its neighbours. The pair (L, L^*) forms a complete geometric descriptor of the embedding, generalizing the concept of barycentric embedding. An algebraic expression permits the direct calculation of fractional coordinates. Non-zero co-lattice vectors allow nets with collisions, displacive transitions *etc.* to be dealt with. The method applies to nets of any periodicity and dimension, be they crystallographic nets or not. Examples are analyzed: [alpha]-cristobalite, the seven unstable 3-periodic

minimal nets *etc.*”

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Mathematical Reviews

Citations	From References: 1	From Reviews: 0

MR2493903 (2010b:93074) 93B36 93C42
Yang, Jun [**Yang, Jun**[11]] (PRC-EST-CAM); **Zhong, Shouming** (PRC-EST-CAM);
Xiong, Lianglin [**Xiong, Liang Lin**] (PRC-EST-CAM)

A descriptor system approach to non-fragile H_∞ control for uncertain fuzzy neutral systems. (English summary)

Fuzzy Sets and Systems **160** (2009), *no. 4,* 423–438.

Summary: “In this paper, the problem of non-fragile H_∞ control for a class of uncertain Takagi-Sugeno (T-S) fuzzy neutral systems with linear fractional parametric uncertainties is considered. The non-fragile H_∞ control problem is to design a state feedback controller such that the $\mathcal{L}_2$-induced gain of the mapping from the exogenous input to the controlled output is less than some prescribed level. Based on the Lyapunov-Krasovskiĭ functional, the descriptor model transformation and the LMI approach, new sufficient conditions for the solvability of this problem are obtained. It is shown that, by a novel controller design method, the desired state feedback fuzzy controller can be constructed by solving a set of LMIs and the minimum H_∞ disturbance attenuation level can be obtained via using the LMI solver `mincx`. Finally, an illustrative numerical example is provided, to demonstrate the correctness and effectiveness of the theoretical results.”

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Citations	From References: 2	From Reviews: 0

MR1166034 (93a:93059) 93C05 03B15
Kuijper, M. [**Kuijper, Margreta**] (NL-MATH)

Descriptor representations without direct feedthrough term.

Automatica J. IFAC **28** (1992), *no. 3,* 633–637.

Summary: “Descriptor representations are considered that are given by (E, A, B, C, D) with $D = 0$. Minimality under external equivalence is characterized in terms of the matrices E, A, B and C. Also, transformations are given by which minimal (E, A, B, C) representations are related under external equivalence. The transformations turn out to be more simple than in the ‘$D \neq 0$’ case. Algorithms for rewriting an (E, A, B, C, D) representation in (E, A, B, C) form are also given. Finally, a realization procedure is presented for obtaining a minimal (E, A, B, C) representation for a system that is given in polynomial matrix fractional form.”