World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

A New Approach to Interval Matrices and Applications

Authors : Obaid Algahtani

Abstract : An interval may be defined as a convex combination as follows: I=[a,b]={x_α=(1-α)a+αb: α∈[0,1]}. Consequently, we may adopt interval operations by applying the scalar operation point-wise to the corresponding interval points: I •J={x_α•y_α αϵ[0,1],x_α ϵI ,y_α ϵJ}, With the usual restriction 0∉J if • = ÷. These operations are associative: I+(J+K)=(I+J)+ K, I*(J*K)=(I*J)* K. These two properties, which are missing in the usual interval operations, will enable the extension of the usual linear system concepts to the interval setting in a seamless manner. The arithmetic introduced here avoids such vague terms as ”interval extension”, ”inclusion function”, determinants which we encounter in the engineering literature that deal with interval linear systems. On the other hand, these definitions were motivated by our attempt to arrive at a definition of interval random variables and investigate the corresponding statistical properties. We feel that they are the natural ones to handle interval systems. We will enable the extension of many results from usual state space models to interval state space models. The interval state space model we will consider here is one of the form X_((t+1))=AX_t+ W_t, Y_t=HX_t+ V_t, t≥0, where A∈ IR^(k×k), H ∈ IR^(p×k) are interval matrices and W _t ∈ IR^k,V_t ∈IR^p are zero – mean Gaussian white-noise interval processes. This feeling is reassured by the numerical results we obtained in a simulation examples.

Keywords : interval analysis, interval matrices, state space model, Kalman Filter
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020