

# Accepted Manuscript



Regular paper

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PII: S1434-8411(17)31579-0  
DOI: <https://doi.org/10.1016/j.aeue.2017.12.036>  
Reference: AEUE 52186

To appear in: *International Journal of Electronics and Communications*

Received Date: 28 June 2017  
Accepted Date: 30 December 2017

Please cite this article as: P. Kokil, X. Arockiaraj S., S. Jogi, H. Kar, New realizability criterion for digital filters with external disturbance and saturation arithmetic, *International Journal of Electronics and Communications* (2017), doi: <https://doi.org/10.1016/j.aeue.2017.12.036>

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# New realizability criterion for digital filters with external disturbance and saturation arithmetic

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## Abstract

An improved stability criterion for fixed-point state-space digital filters in the occurrence of external disturbance and saturation nonlinearities by using induced  $l_\infty$  approach is presented. The realization of state-space digital filters which is free from limit-cycles is brought out by utilizing a better characterization of the saturation nonlinearities and free-weighting matrices. The proposed criterion promises exponential stability and also diminishes the influence of external disturbance to a prescribed induced  $l_\infty$  norm constraint. The superiority of the suggested method for filter design is exemplified by means of numerical examples.

**Keywords:** Digital filter, External disturbance, Linear matrix inequality, Nonlinear system, Stability

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## 1. Introduction

The past decades have seen intensified research attention in the area of digital signal processing which has resulted in extensive investigation of properties and performance of digital filters in various areas such as digital hearing aids, telecommunications, medical electronics,

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