

# Statistical Analysis of the Kumaresan–Tufts and Matrix Pencil Methods in Estimating a Damped Sinusoid\*

El-Hadi Djermoune and Marc Tomczak

Centre de Recherche en Automatique de Nancy – CRAN UMR-CNRS 7039  
Université Henri Poincaré Nancy 1, Boulevard des Aiguillettes  
BP. 239 – 54506 Vandoeuvre-lès-Nancy Cedex, France  
firstname.lastname@cran.uhp-nancy.fr

## Abstract

Several methods have been developed for estimating the parameters of damped and undamped exponentials in noise, but the performances of such techniques are generally known only in the undamped case. In this paper, we consider two estimation methods: the Kumaresan–Tufts method and the Matrix Pencil approach, and we obtain their estimation performances in the case of a single exponentially damped sinusoid. Assuming a high signal-to-noise ratio, closed form expressions for the bias and the variance of the damping factor are derived. The analytical results are confirmed using Monte Carlo simulations. The analysis indicates that the Matrix Pencil method exhibits a lower variance but has a greater bias than the Kumaresan–Tufts approach.

*Key words:* Linear prediction; Statistical analysis; Damped sinusoid.

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