

# Phase-Based, Time-Domain Estimation of the Frequency and Phase of a Single Sinusoid in AWGN

Dr. Fu Hua, Department of Electrical and Computer Engineering,  
National University of Singapore

**Monday January 19, 2015**  
**5pm – 6pm**  
**SMART Enterprise Wing Level 5,**  
**Perseverance Rooms 1 & 2**

In this talk, the exact statistical models for the measurement phase noise in estimating the frequency and phase of a single sinusoid over the additive white Gaussian noise channel are presented. The a posteriori probability density function (PDF) and the a priori PDF of the phase noise are given by explicit, closed-form expressions that are valid for arbitrary signal-to-noise ratios. It is shown that as far as estimating the single sinusoid angle parameters is concerned, the phase of the received signal samples alone is a sufficient statistic, provided that the phase noise is modeled by the a posteriori PDF, which has a Tikhonov distribution.

Furthermore, we illustrate that the results derived can yield various phase noise models as special cases, and the underlying physical insights and interconnections that exist among these models are revealed. The application of these models to the design of linear minimum variance estimator is presented, and their estimation performances are compared.



Fu Hua is with the Department of Electrical and Computer Engineering, National University of Singapore. His research interests include communication theory, wireless communication, detection, estimation and statistical signal processing.