Abstract: Estimation of a mobile's attitude consists of finding the rotation between the vehicle coordinate frame and another reference frame. Attitude determination systems use known direction-of-arrival of some signals in the reference system, such as the light from a star, and measure these directions with sensors in the local frame. Global Positioning System (GPS) signals are useful as well, since the position of the satellites and the vehicle are calculated by a standard GPS in the reference frame. Therefore, in a vehicle provided with an array of GPS antennas with associated receivers tracking the incoming signals phase, the attitude can be estimated. Previous approaches either convert phase measurements to vector observations or utilized single or double-differences of them as observations but they did not properly consider the correlation produced by the differentiation. For the case of instant attitude estimation we derive the Maximum-Likelihood Estimator (MLE) for double-difference observations. This leads to a Weighted Orthogonal Procrutes Problem (WOPP) that unlike the Orthogonal one (OPP) does not have a closed-form solution in terms of a SVD. We solve it by a specially devised optimization procedure, which is a steepest descent-like algorithm, but constrained to the class of special orthogonal 3 x 3 matrices, SO(3). Then, for the evolution of the vehicles attitude a dynamic model is adopted and a Kalman filtering approach followed. Rather than considering a dynamic model for the attitude matrix itself - or any other possible representation - which leads to complex non-linear models, we adopted a linear one for the antenna array baselines. In this way the array structure information can be added as a constraint to the dynamic model. Simulated and experimental results are shown.

Host: Dr. Arye Nehorai

10:00 - 10:50 a.m.
Bryan Hall 305

Short Bio: Pedro A. Roncagliolo received the Electronics Engineer degree from the National University of La Plata (UNLP) Argentina in 2001. He is currently Ph.D. student with a scholarship of CONICET and Lecturer in the UNLP. His research interests are in Statistical Signal Processing with applications to Wireless Communications and Global Navigation Satellite Systems (GNSS).