

Brownian motion and Ornstein-Uhlenbeck processes in planar shape space

Mousa Golalizadeh*, Ian L. Dryden and F.G. Ball

University of Nottingham

We discuss Brownian motion and Ornstein-Uhlenbeck processes specified directly in planar shape space. In particular, we obtain the drift and diffusion coefficients for Kendall's shape variables and Goodall-Mardia polar shape variables. Stochastic differential equations are given and the equilibrium distributions are obtained. By adding in extra drift to a reference figure, Ornstein-Uhlenbeck processes can be studied, for example with equilibrium distribution given by the complex Watson distribution. The triangle case is studied in particular detail, and some simulations given. Connections with the diffusion of Euclidean shape (Kendall, 1990) are made, where the original points themselves diffuse in the plane.

Statistical inference for the parameters in the models is also investigated using Markov chain Monte Carlo simulation and maximum likelihood.

Reference

Kendall, W.S. (1990). The Diffusion of Euclidean Shape. In. *Disorder in Physical Systems*. 203-217. Edited by G.Grimmett and D. Welsh. Cambridge University Press.