BISP8

Eighth Workshop on
BAYESIAN INFERENCE IN STOCHASTIC PROCESSES

Bayesian estimation of thermal conductivity and temperature profile in homogeneous masses

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A detailed knowledge of the thermal properties of a mass, and in particular of the thermal conductivity, is highly important in a large number of applications and industrial thermal processes. However, this information is not always available and has to be estimated once a specific mass is taken. In particular, for polymers, the actual value of thermal conductivity within the range of the material class is often unknown. Also for alloys and composite materials, the thermal conductivity is between the ones of the components but unknown.
ISO standards propose different methods for measuring the thermal conductivity, which require complex and expensive experimental layouts, while other simpler but accurate methods are not widespread.
We propose a Bayesian estimation procedure coupled with a simple experimental layout to jointly estimate the thermal conductivity of a homogeneous body and to reproduce the entire temperature profile evolution over time by generating latent temperature data. Based on the temperatures acquired in few points, the posterior density of the thermal conductivity and the evolution of temperature in latent points are derived with an MCMC algorithm.
Results show the validity of the approach and the applicability to real cases.

Keywords:
Heat Equation; Thermal Conductivity Estimation; Latent Temperatures; MCMC.

ABSTRACT BISP8.13
TYPE Young researcher Ettore Lanzarone invited to contribute