ABSTRACT for POSTER presentation at AIP 2005

Novel evolution strategies for the solution of 3D shape inverse problems in medical imaging with light.

Authors:
Athanasios Zacharopoulos and Oliver Dorn,
Universidad Carlos III de Madrid, Spain
(joint work with Simon Arridge and Martin Schweiger, UCL, London)

Abstract:

In medical imaging typically the problem arises that spatially varying parameters of a given PDE need to be reconstructed from indirect physical measurements of the fields. For example, in diffuse optical tomography and in fluorescence tomography the absorption and the scattering parameter of a transport equation (or a simplified diffusion equation) are sought for imaging parts of the human body. Designing efficient reconstruction schemes, which can be applied in a stable way to 3D data, still poses great computational difficulties and mathematical challenges to the practitioner. We present novel reconstruction schemes, which have the goal to finally yield fully 3D reconstructions from a (possibly small) set of 3D data. For this purpose we use the assumption that the unknown objects can be characterized as shapes with a well-defined (but possibly only approximately known) parameter contrast to the known background distribution. These techniques start with an initial guess of the shape and define a shape evolution for solving the inverse problem. During the evolution, the shapes are constrained to stay in a certain class of shapes. We will present numerical examples in 2D and in 3D, which demonstrate the performance of these techniques.