G-CSC Kolloquium

Variational Models in Shape Space and Links to Continuum Mechanics

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Abstract

The analysis of shapes as elements in a frequently infinite-dimensional space of shapes has attracted increasing attention over the last decade. The aim of this talk is to adopt a primarily physical perspective on the space of shapes and to relate this to the prevailing geometric perspective. Indeed, we consider shapes given as boundary contours of volumetric objects, which consist either of an elastic solid or a viscous fluid.

In the first case, shapes are transformed via elastic deformations, where the associated elastic energy only depends on the final state of the deformation and not on the path along which the deformation is generated.

The minimal elastic energy required to deform an object into another one can be considered as a dissimilarity measure between the corresponding shapes. We apply this approach for shape averaging and shape statistics.

In the second case, shapes are transformed into each other via viscous transport of fluid material, and the flow naturally generates a connecting path in the space of shapes. The viscous dissipation rate---the rate at which energy is converted into heat due to friction---can be defined as a metric on an associated Riemannian manifold.