Computational Topology in Reconstruction, Mesh Generation, and Data Analysis

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Many applications involving shapes and data not only require analyzing and processing their geometries, but also associated topologies. In the past two decades, computational topology, an area rekindled by computational geometry has emphasized processing and exploiting topological structures of shapes and data. The understanding of topological structures in the context of computations has resulted into theoretically sound practical algorithms and has also put a thrust in developing further synergy between mathematics and computations in general. This talk aims to delineate this perspective by considering three applications, namely, (i) surface/manifold reconstructions, (ii) mesh generation, and (iii) topological data analysis for which computational topology has played a crucial role.

For each of the three topics, we will give the necessary backgrounds in topology, state some of the key results, and indicate open questions/problems. The hope is that the talk will further stimulate the interest in tying topology and computation together.

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