Homework 4: Inter-Object Morphing

Description:

In homework 3, we have learned how to map a genus-0 open surface (topological disc) onto a unit disk. Given two genus-0 open surfaces M1, M2, we are then able to compute the morphing between them via a same disc domain.

The method is first compute the harmonic mapping f1 : M1 → D, then compute the harmonic map f2 M2→ D, you can compose f1 and f2 to get $f=f2^{-1}$ f1 = M1 → M2.

1) Point Location

   Given a triangulation T(D) of D, and another point p in D, p must locates in one triangle of T(D). Find out this triangle by checking barycentric coordinates.

2) Barycentric Interpolation

   If a point p in a triangle t=(v1,v2,v3) of T(D), and its respective barycentric coordinate (BC) is (a1, a2, a3), then p = a1v1+a2v2+a3v3. M1 is flattened with connectivity T1(D), and M2 is flattened with connectivity T2(D), a point p1 is mapped by f1 to a planar triangle's vertex p, p must locates in a triangle t2 of T2(D), (coming from a triangle t=(u1,u2,u3) of M2), compute its BC(a1,a2,a3). Then under the piecewise composed map, p1 shall be mapped to a1u1+a2u2+a3u3.

3) Linear interpolation for morphing

   For each vertex v1 in M1, compute its target position v2=a1u1+a2u2+a3u3 as described in step 2. Then you can generate a sequence of position vt = v1 * (1-t) + v2 * t for time t = 0 → 1.

Data and format:

Two test models are provided in this package: Susan.m and Alex.m

Compute their linear interpolation and morphing (sampled in 10 frames)