Computer Graphics - Exercise 3

20/03/2003

Question 1

Prove that the linear system of equations defined by the convex mapping method (see slides $19-20$ in `cg_ex8.ppt`) has a unique solution. I.e., denote by A the matrix of the system and prove that $Ax = 0 \Leftrightarrow x = 0$.

Question 2

In both convex and harmonic mappings, why are the boundary vertices are constrained to be on a *convex* polygon boundary? What might happen if arbitrary simple polygon is used?

Question 3

Show that the $k_{i,j}$ spring constants in harmonic mapping (slide 27) can be also expressed as:

$$k_{i,j} = (L_{i,k_1}^2 + L_{j,k_1}^2 - L_{i,j}^2)/Area_{i,j,k_1} + (L_{i,k_2}^2 + L_{j,k_2}^2 - L_{i,j}^2)/Area_{i,j,k_2}.$$

Here, $\{i, j, k_1\}$ and $\{i, j, k_2\}$ denote the two triangles that lie on the edge (i, j) and $L_{i,j}$ denotes the length of edge (i, j).