

Scientific Visualization – Homework 5

Submission: June, 4th, 2020, 10:15 am, via email

1. Exercise

(5 points)

Let $n, \tilde{n} \in \mathbb{R}^d$ and $n \otimes \tilde{n} := n \cdot \tilde{n}^T$.

1.) Determine $\text{rank}(n \otimes \tilde{n})$.

2.) Let $n' = \begin{pmatrix} -\epsilon \\ 1 \end{pmatrix}$ and $\tilde{n}' = \begin{pmatrix} \epsilon \\ 1 \end{pmatrix}$, $\epsilon > 0$, be two normal vectors of polygon consisting of two edges centered at the origin.

a) Determine and sketch the level lines of the quadratic form $n \otimes \tilde{n}$, where $n = \frac{1}{\|n'\|} n'$ and $\tilde{n} = \frac{1}{\|\tilde{n}'\|} \tilde{n}'$, depending on ϵ (e.g. $\epsilon = 0$, $\epsilon = 0.1$, and $\epsilon = 1$).

b) Discuss which positions have smaller errors than others related to the shape of the polygon.

2. Exercise

(7 points)

Let the polygon P be given by the following set of vertices

$$p_0 = \begin{pmatrix} -2 \\ -1 \end{pmatrix}, p_1 = \begin{pmatrix} -1 \\ 0 \end{pmatrix}, p_2 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, p_3 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}.$$

Perform an collapse of the edge $e = (p_1, p_2)$:

1.) determine the error metric \mathcal{Q}_e ,

2.) determine the minimizer q_e of \mathcal{Q}_e , and

3.) perform the collapse of e . Sketch the original polygon and the simplified one.

3. Exercise

(4 points)

Create exactly five slides (in PowerPoint) to present the content of your programming project: Give a brief overview of your topic and the tasks you are going to handle.

Name your submission file `Projecttitle_NameOfStudent_NameOfOtherStudent.pdf`.

Total: 16