

Isogeometric Analysis Homework

November 12, 2008

Due Monday 11/17. Hand in room 3.402.

- Piegl and Tiller 2.1, 2.2, 2.6 (you do not need to trace through Algorithm 2.3 and compute the first and second derivatives)
- Piegl and Tiller 3.5 (you do not need to compute $\mathbf{C}'(u)$ or sketch it, but explicitly compute $\mathbf{C}(0)$, $\mathbf{C}(\frac{1}{4})$, $\mathbf{C}(\frac{1}{2})$, $\mathbf{C}(\frac{3}{4})$, and $\mathbf{C}(1)$ along with the sketch of $\mathbf{C}(u)$)
- Piegl and Tiller 3.8
- Plate with a Hole: Write a script in MATLAB or other programming language to plot the quarter of a plate with a hole. Its knot vectors are $\Xi_1 = \{0, 0, 0, 0.5, 1, 1, 1\}$ and $\Xi_2 = \{0, 0, 0, 1, 1, 1\}$, and the control points and weights are given in Tables 1 and 2, respectively. Algorithms A2.1, A2.2, and A3.5 from Piegl and Tiller may prove useful. Provide the following:
 - Plot of the control net.
 - Plot of the quarter plate with hole in physical space. Do this by plotting the points $\mathbf{S}(0.01i, 0.01j)$ for $0 \leq i, j \leq 100$ and plotting the isoparametric lines (lines of constant u or v) by interpolating the appropriate points.
 - Plot of each basis function in the parameter space. Plot each function's value at $(0.01i, 0.01j)$ for $0 \leq i, j \leq 100$. There will be 12 plots total. You may find the MATLAB command `surf()` useful here.
 - Plot of each basis function in the physical space.

i	$\mathbf{P}_{i,1}$	$\mathbf{P}_{i,2}$	$\mathbf{P}_{i,3}$
1	$(-1, 0)$	$(-2.5, 0)$	$(-4, 0)$
2	$(-1, \sqrt{2} - 1)$	$(-2.5, 0.75)$	$(-4, 4)$
3	$(1 - \sqrt{2}, 1)$	$(-0.75, 2.5)$	$(-4, 4)$
4	$(0, 1)$	$(0, 2.5)$	$(0, 4)$

Table 1: Control net for the plate with a circular hole.

i	$w_{i,1}$	$w_{i,2}$	$w_{i,3}$
1	1	1	1
2	$(1 + 1/\sqrt{2})/2$	1	1
3	$(1 + 1/\sqrt{2})/2$	1	1
4	1	1	1

Table 2: Weights for the plate with a circular hole.