T U T O R I A L

"Computational Electromagnetics"

to the lecture

"Numerical Methods in Electrical Engineering"

Tutorial 07 Thursday, June 17, 2010 (Time: 15:30 – 16:15; Room: T 212)

25 Let us consider a regular triangulation $\tau_h = \{T\}$ of a polygonally bounded two-dimensional domain $\Omega \subset \mathbf{R}^2$ into triangles T. Let $V_T = P_1(T)$ be the local space of affine linear function. Let the local functionals (= dofs) $\psi_\alpha = \psi_{T,\alpha} : v \in V_T \to v(V_\alpha)$ be associated with the vertices V_α where $\alpha = 1, 2, 3$. Two local functionals $\psi_{T,\alpha}$ and $\psi_{\tilde{T},\beta}$ are identified if they are associated with the same global vertex. We write $\psi_{T,\alpha} \equiv \psi_{\tilde{T},\beta}$. Show that the global fe space

$$V_h = \{v \in L_2(\Omega) : v|_T \in V_T \wedge \{\psi_{T,\alpha} \equiv \psi_{\tilde{T},\beta} \Rightarrow \psi_{T,\alpha}(v|_T) = \psi_{\tilde{T},\beta}(v|_{\tilde{T}})\}\}$$

is a finite-dimensional subspace of $H^1(\Omega)$ with $\dim V_h = \#\text{vertices}$!

26 Let us consider a regular triangulation $\tau_h = \{T\}$ of a polygonally bounded two-dimensional domain $\Omega \subset \mathbf{R}^2$ into triangles T. Let $V_T = \mathcal{N}_0$ be the local space of the lowest-order Nédeléc functions. Let the local functionals (= dofs) $\psi_{E,\alpha\beta}$ which are associated with the three edges of T be defined as in Definition 3.4 of the Lectures. Show that the global fe space

$$V_h = \{v \in L_2(\Omega) : v|_T \in V_T \wedge \{\psi_{E,\alpha\beta} \equiv \psi_{\tilde{E},\tilde{\alpha}\tilde{\beta}} \Rightarrow \psi_{E,\alpha\beta}(v|_T) = \psi_{\tilde{E},\tilde{\alpha}\tilde{\beta}}(v|_{\tilde{T}})\}\}$$

is a finite-dimensional subspace of $H(curl, \Omega)$ with $\dim V_h = \#\text{edges}$!