

Self-assessment test #2

1TD253: Finite element methods, 5.0 hp

Præparatus supervivet

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Uppsala, November, 2012

1. **True/False:** Let $I = (0, 1)$. Then

$$\int_I uv + u_x v_x dx \leq \left(\|u\|_{L^2(I)}^2 + \|u_x\|_{L^2(I)}^2 \right)^{1/2} \left(\|v\|_{L^2(I)}^2 + \|v_x\|_{L^2(I)}^2 \right)^{1/2}.$$

2. **True/False:** The orthogonal projection P_h onto the space V_h , is the minimizer f^* of $\|f - f^*\|_{L^2}$.

3. **True/False:** The following problem

$$\begin{aligned} u_t &= -u_{xx} + f, & x \in I = (0, 1), \\ u(t=0, x) &= u_0(x), \\ u(t, 0) &= u(t, 1) = 0, \end{aligned}$$

is well-posed.

4. **True/False:**

$$\|u + v\| \leq \|u\| + \|v\|.$$

5. **True/False:** For an orthogonal basis, the mass-matrix is tri-diagonal.

6. **True/False:** The following problem

$$\begin{aligned} -u_{xx} &= f, & x \in I = (0, 1), \\ u_x(0) &= u_x(1) = 0, \end{aligned}$$

is well-posed.

7. **True/False:** For an orthonormal basis, the mass-matrix is the identity.
8. **True/False:** For the orthogonal projection P_h onto the space V_h , $P_h^2 f = P_h f$.
9. **True/False:**

$$\|u + v\|^2 \leq \|u\|^2 + \|v\|^2.$$

10. **True/False:** Suppose $u \perp v$. Then

$$\|u + v\|^2 = \|u\|^2 + \|v\|^2.$$

11. **True/False:** *A priori* error estimates are difficult to use for mesh adaptivity.
12. **True/False:** *A posteriori* error estimates depend on the analytical solution.
13. **True/False:** Robin boundary conditions include both Dirichlet and Neumann conditions as special cases.
14. **True/False:** One can solve the heat equation backwards in time, but only in a short time interval.