Final Exam. of Boundary Element Method

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Ghei Hong Hall, 20/1 18:00-20:00, Evening, 1995

1. Explain the following items. (50%)
   (a). dual integral formulation
   (b). dual boundary element method
   (c). hypersingular integral equation
   (d). fictitious eigenvalue, numerical resonance
   (e). kernel function
   (f). Fredholm and Volterra integral equations, first kind and second kind ?
   (g). exterior problem
   (h). order analysis
   (i). Green's function, fundamental solution and free space Green's function
   (j). two point function
2. Why dual integral formulation ? (10%)
3. The fundamental solution is defined as follows

$$\frac{d^2U(x,s)}{dx^2} = -\delta(x-s)$$

The dual integral equations are shown

$$u(x) = [U(s,x)\frac{du(s)}{ds} - T(s,x)u(s)] \,|_{s=0}^{s=1}$$

$$\frac{du(x)}{dx} = [L(s,x)\frac{du(s)}{ds} - M(s,x)u(s)] \,|_{s=0}^{s=1}$$

(a). Determine $U(s,x), T(s,x), L(s,x)$ and $M(s,x)$ for $x > s$ and $x < s$. (10%)
(b). Plot $U(s,x), T(s,x), L(s,x)$ and $M(s,x)$ versus x for $0 < x, s < 1$. (10%)
(c). Determine (10%)

$$\lim_{x\to 1^-} U(0,x) = ?$$

$$\lim_{x\to 0^+} T(0,x) = ?$$

$$\lim_{x\to 1^-} L(0,x) = ?$$

$$\lim_{x\to 0^+} M(1,x) = ?$$

(d). Based on the dual integral formulation, solve (10%)

$$\frac{d^2u(x)}{dx^2} = 0$$

subject to $u(0) = 0, u(1) = 1$. Any comments on the L, M equation ?