九十六學年度第一學期土研所博士班資格考試(96.10.26)
有限元素法

(1) A second-order ordinary differential equation with variable coefficients and its corresponding boundary conditions are given as follows.

GE: $\dfrac{d}{dx}\left(a(x)\dfrac{du(x)}{dx}\right)+b(x)=0$ in $0<x<1$ (1a)

BCs: $u(x=0)=0$

$a\dfrac{du}{dx}\Big|_{x=1}=P;$ (1b)

where $u(x)$ is the unknown function; $a(x)$ and $b(x)$ are given functions.

(a) State a physical problem of which governing equation and possible boundary conditions refer to Eqs. (1a) and (1b).   (10%)

(b) Construct the weak forms.   (10%)

(c) Let $a(x)=1+x$, $b(x)=0$ and $a(1)=2$. Determine the exact solution of $u(x)$.   (10%)

(d) Let $a(x)=1+x$, $b(x)=0$ and $a(1)=2$. Compute the 2-parameter Ritz approximation of Eqs. (1a) and (1b) using algebraic polynomials as the approximate functions.   (15%)

(e) Let $a(x)=1+x$, $b(x)=0$ and $a(1)=2$. Compute the finite element solution using two linear elements with a uniform mesh.   (15%)

(2) (a) Construct the weak forms for the following equations which govern the static behavior of a beam on elastic foundation.   (15%)

GE: $\dfrac{d^2}{dx^2}\left(b\dfrac{d^2w}{dx^2}\right)+kw=f$ in $0<x<L$

BCs: $w=b\dfrac{d^2w}{dx^2}=0$ at $x=0$ and $x=L$.

(b) Derive the characteristic equations for a beam element by letting $w^{(e)}=w_1^{(e)}\phi_1+\left(\dfrac{dw_1^{(e)}}{dx}\right)\phi_2+w_2^{(e)}\phi_3+\left(\dfrac{dw_2^{(e)}}{dx}\right)\phi_4$, where ϕ_i denote the shape functions.

The stiffness matrix can be expressed in terms of ϕ_i.   (15%)

(3) State how to determine the shape functions for the five-node rectanguler element.   (10%)

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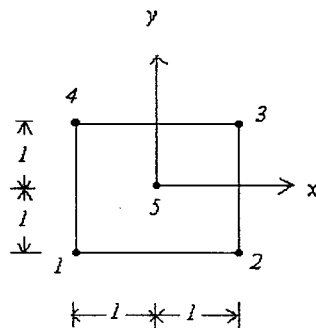
結構動力資格考題目

1. Please find (1) the mass and stiffness matrices (Fig.2a) 15%;   (2) Find the natural frequencies and mode shapes 15%; (3) If the damping ratio is equal to 0.05, please find the displacements of the system under the loads shown in Fig.2b 20%;   (4) If the response- spectrum figure is shown in Fig.2c. Please solve this problem by using response-spectrum analysis 20%. (Total 70%) 本題爲兩個自由度之結構動力題目，是基礎的題型，有標準答案，請盡力答題。
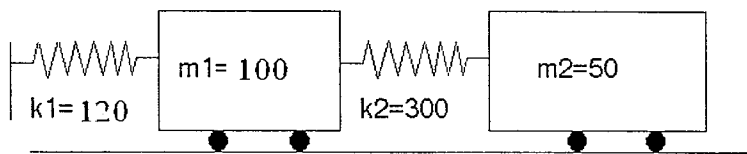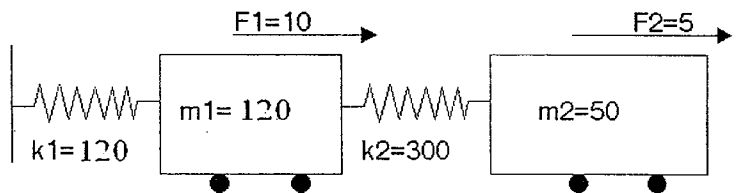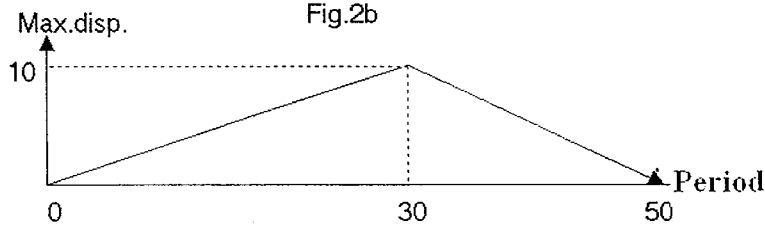

Fig.2a

Fig.2b

Fig.2c

2. 你認爲結構動力課程之內容應包括那些範圍，並簡述其內容。無標準答案，想像此題當成你的論文題目，請盡力答題。(15%)

3. 當外力一直以固定頻率之 Sine 波運行，請說明鄰近之結構振動行爲，你是否能量測到結構之自然頻率，請說明理由。(15%)

96 學年度第一學期博士班資格考

土壤力學

考試時間：100min.

及格：60 分

1. 試繪圖說明砂質水平地盤在下列情況之有效應力路徑(不考慮地下水之影響)：

   (1) 地表之剛性基礎鉛直加載時，基礎正下方之土壤元素(10%)

   (2) 地表之剛性基礎鉛直加載時，被動土楔中之土壤元素(10%)

   (3) 深開挖四週之土壤元素(10%)

   (4) 深開挖正下方土壤元素(10%)

2. 比較正常壓密(Normally consolidated)土壤及過壓密(Over-consolidated)土壤之不排水剪力強度(Undrained shear strength)之差異(15%)。並說明在高度過壓密土壤之地盤中，以$\phi = 0$ (或不排水剪力強度)進行穩定分析是否恰當。(15%)

3. 說明邊坡穩定分析中常用之切片法(Slice method)之特色(15%)。並以算式說明為何切除坡腳常造成邊坡不穩定(15%)。

九十六學年度第一期博士學位候選人資格考試

考試科目: 工程地質

一. 解釋名詞 (10%)

(1) 何謂走向、傾角、傾向? (6%)

(2) 何謂 Rock Quality Designation (RQD)? (4%)

二. 試述岩石地層單位之劃分基準、劃定單位,及舉出 3 個岩石地層單位(15%)

三. 試述我國 5 條地震斷層 (15%)

四. 試述不連續面的種類與特性。 (15%)

五. 請由板塊活動觀點敘述臺灣之地質分區與各區主要的岩盤種類。 (25%)

六. 近年全球暖化的影響逐漸明顯,試提出 4 項未來可能因全球暖化而嚴重化的工程地質災害與其各別肇因與全球暖化的關係。 (20%)