國立中央大學 110 學年度碩士班考試入學試題

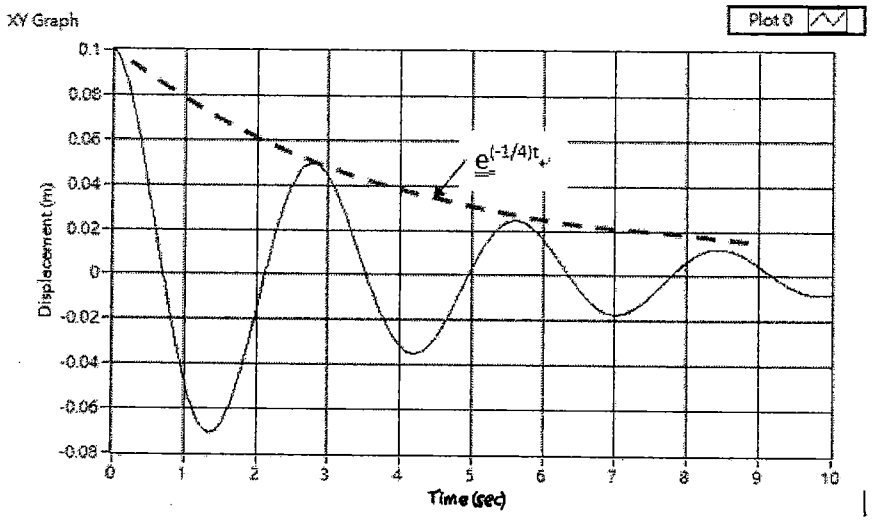
所別： 土木工程學系 碩士班 力學與結構工程組(一般生) 共 1 頁 第 1 頁

科目： 工程數學

本科考試禁用計算器 ＊請在答案卷(卡)內作答

※計算題需計算過程，無計算過程者不予計分

1. let mass-spring-damping system with damping constant c = 2 kg/m, spring constant k =20 kg/s^2, and mass is unknown:
   (1) If the mass displacement y(t) (solid line) is shown in following figure with y(0) = 1 m, y'(0)=0 m/s, please find mass m= ? kg (10%)



   (2) If the upper system has an applied external force r(t)= sinωt, please find the ω=ω$_{max}$ to have the maximum amplification (15%)
   (3) If the upper applied external force r(t)= sin2t which only exists at $0 \le t \le \pi$, please find the related mass displacement y(t) by Laplace transform (15%)
   (4) If

$$y(t) = \sum_{m=0}^{\infty} a_m x^m$$

   for the upper system which is assumed as an undamped and homogeneous one, please show the solution of y(t) in series form (10%)

2. 試說明矩陣的相似變換在特徵值與特徵向量的特性(25%)

3. $f = \frac{1}{\sqrt{x^2+y^2+z^2}}$, 在$P$:(2, 0, 4), 沿著 方向$\vec{a} = [1,2,1]$

求方向導數(25%)