Civil Engineering
USC

CE 541a - Computer Assignment No. 4

Write a computer program (FORTRAN, C, Matlab, Mathematica, etc.) to find the first k mode shapes and natural frequencies of an n-degree-of-freedom structural system, having a mass matrix M and stiffness matrix K, by the *Power Method* using matrix iteration with sweeping:

$$D_s = D_{s-1} - \lambda_{s-1}\underline{u}_{s-1}\underline{u}_{s-1}^T M, \qquad s = 2, 3, \ldots, n \qquad (1)$$

where D is the *dynamical matrix* given by:

$$D = K^{-1}M \qquad (2)$$

and where

> λ_s is eigenvalue number s
>
> $\underline{u}_s$ is eigenvector number s normalized so that $\underline{u}_s^T M \underline{u}_s = 1$

- As input, your program should read $n, [M], [K],$ and k.

- As output, your program should return $n, [M], [K], [K]^{-1}, k,$ and $\omega_i, X^{(i)}, (i = 1, 2, ..., k).$

To verify that your program works, use it to obtain all the natural frequencies and mode shapes of the 3DOF system discussed in Example 7.5 in the textbook. Experiment with different choices for the initial guess vector, and its effect on the rate of convergence.