UNIVERSITY OF NAIROBI

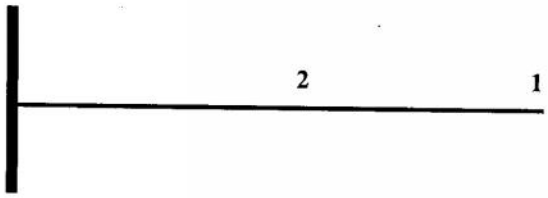
DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FME 411 - MECHANICAL VIBRATIONS

RAYLEIGH'S METHOD FOR A CANTILEVER WITH POINT LOADS

Rayleigh's energy method gives the following expression:

$$\varpi = \frac{g\sum My}{\sum My^2}$$



Where ϖ = Natural frequency of traverse vibrations
M = Mass at position **1, 2.**
y = Static deflection under corresponding mass.

The method is advantageous when applied to large structure, where it is more practical to measure static deflection than to measure frequency directly.

Determining The Static Deflections

Load the beam at position **1** and measure deflections at positions **1 and 2.**
Use **four** increments of load.
Repeat load at position **2.**

Use the **principle of superposition** to find the deflections due to the masses used in part **2** of the experiment.
Account for the beam mass $\mathbf{M}_b$ by adding a correction to the end mass $\mathbf{M}_1$.
(An additional mass of $\frac{33}{140}\mathbf{M}_b$; ***see W. T. Thomson pp. 9, 20).***

Determining The Natural Frequency Directly.

Chose **two** of the following load combinations; attach to the beam and obtain the natural frequency directly.

Position	**1**	0.198	0.432	0.764	1.284	**Kg.**
Position	**2**	0.432	0.198	0.432	0.764	**Kg.**

Compare your results.
Comment on method, accuracy etc.

LOADING AT POSITION 1		
READINGS		
MASS	POSITION 1	POSITION 2

LOADING AT POSITION 2		
READINGS		
MASS	POSITION 1	POSITION 2