1) Assuming that , so that,

For

and for

2.

Solving for ;

3. The coordinates, and follow the relation . Further the pulley is assumed to be a thin circular disk, so that

Equation of Motion from FBDs

Assuming

For

and for

Assuming,

So that

Equations 3.1-2 can be expressed in matrix form as;

i.e.

For a non-trivial solution,

Now from the Quadratic Formula, the Natural Frequencies of the system are

That is,

And for the mode shapes

Thus the shape for mode 1 is defined by

and for mode 2

4. Assuming that , so that,

For

and for

Assuming

So that, for

Equations 1 and 2 can be expressed in matrix form as;

i.e.

For a non-trivial solution,

Now from the Quadratic Formula, the Natural Frequencies of the system are

Thus

And for the mode shapes

Thus the shape for mode 1 is defined by

and for mode 2

Thus

From the initial conditions; , ,

and