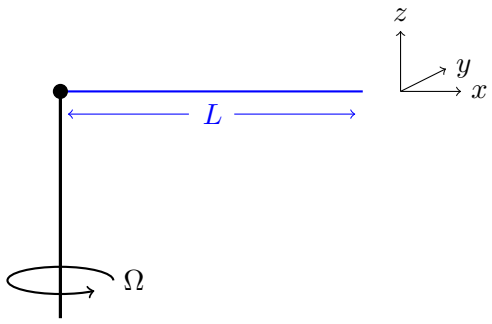
Wave on a Rotating String

A string of length L and mass per unit length λ is tied down at one end to a rod rotating at angular speed Ω, and the other end is left free. Assume that the rotation is fast enough so that gravity is negligible.



(a) This string can oscillate in both the y direction, and the z direction. Show that y and z obey two different wave equations, and find the equation for each.

(b) Find the normal modes and their associated frequencies.[1]

[1] The answer should involve Legendre polynomials.