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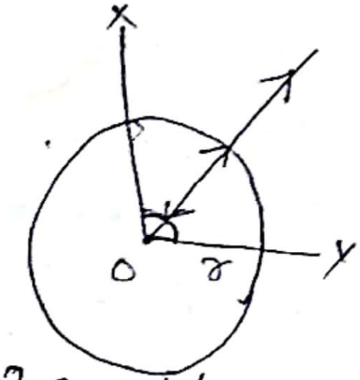
Sem I, MJC-3/Unit IV

Centrifugal force



Centrifugal force ⟶

Lets consider a mass m, moving on the circumference of a circle of radius r with an angular velocity ω. Consider a stone attached at the end of a string. In an inertial frame, the centripetal force acting on the mass is given by $F_i = -m\omega^2 r$, where r is directed outward from the center O. (1) In case of rotating string with stone, this centripetal force is provided by the tension T of the string, so that $F_i = T = -m\omega^2 r$ (2)

Now suppose that a frame is rotating with an angular velocity ω relative to the inertial frame so that in the rotating frame the mass m is at rest. In this ~~nonin~~ noninertial (rotating) frame, the observed acceleration (a_n) of the mass m is zero that is, $a_n = 0$ and consequently the total force (F_n) is given by $F_n = m a_n = 0$ ——— (3)

Now, $F_i + F_0 = F_n$ ——— (4)

i.e. $-m\omega^2 r + F_0 = 0$, thus $F_0 = m\omega^2 r$ ——— (5)

This fictitious force (F_0) is directed away from the center (along r) and is called the centrifugal force. In the rotating non ~~i~~ inertial frame, the

acceleration (a_m) or, total force (F_m) on the mass (m) is zero and $F_i = T$ for same string arrangement, we have from equation (1) $-T + F_0 = 0$

This means that in the non inertial frame the centrifugal force is balanced by the tension in the string. In the rotating frame, the centrifugal force is equal and opposite to the actual force and both are acting on the same particle. The centrifugal force is a pseudo force and appears in the rotating frame due to its rotation.