Date 29/09/2015
Uni Sem-1 2015

Fictitious/Pseudo force and it related to non-inertial force

Pseudo force or fictitious and its related to non-inertial force → Let us S is an inertial frame and another frame S' is moving with an acceleration of a particle P. On which no external force is acting will be zero in the frame S; but in frame S' the observer will ~~found~~ find that an acceleration $-a_0$ is acting on it. Thus, in frame S' the observed force on the particle is $-ma_0$, where m is the mass of the particle. Such a force, which does not really act on the particle but appears due to the acceleration of the frame, is called fictitious force or pseudo force.

Fictitious force on the particle P is

$$F_0 = -ma_0 \quad \text{---(1)}$$

Here, the accelerated frame S' is non-inertial
Now if a force F_i is applied on the particle and a_i is the observed acceleration in the inertial frame(S), then according to netons law

$$F_i = ma_i \quad \text{---(2)}$$

Suppose frame S' coincidence at $t=0$ with the inertial frame S then at any time t. The position vectors of a particle r_i and r_n the inertial and non-inertial frames respectively are connected as

$$r_i = r_m + \frac{1}{2} a_0 t^2$$

Where a_0 is the acceleration of the frame S' with respect to S. Double differentiation with respect to time t gives

$$\frac{d^2 r_i}{dt^2} = \frac{d^2 r_m}{dt^2} + a_0 \quad \text{---(3)}$$

As $\frac{d^2 r_i}{dt^2} = a_i$ is the acceleration in the inertial frame and $\frac{d^2 r_m}{dt^2} = a_m$ the acceleration observed in the non-~~inertial~~ inertial frame, We can write eqn(3) as

$$a_i = a_m + a_0 \quad \text{---(4)}$$

$$\text{or, } a_i - a_0 = a_m$$

$$\text{or, } ma_i - ma_0 = ma_m \quad \text{---(5)}$$

If we define the force on the particle in the accelerated ~~sys~~ system according to Newtons second law i.e. $ma_m = F_m$, then using eqns (1) and (2) we get.

$$F_m = F_i + F_0 \quad \text{---(6)}$$

Where $F_i = ma$ is the real force acting on the particle and $F_0 = -ma_0$ is the fictitious force. Thus the observer in the accelerated frame will measure the resultant (total) force which is the sum of real and fictitious forces on the particle i.e.

Total force = True force + Fictitious force.