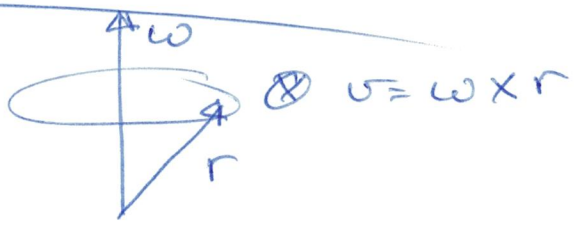
Non-Inertial frames

$$\vec{v} = \vec{\omega} \times \vec{r}$$



$$d\vec{r} = d\vec{r} + \vec{\omega} \times \vec{r}$$

Inertial — Non-inertial

$$d\square = d\square + \vec{\omega} \times \square$$

$$F = ma = m(d^2 r)$$

$$d^2 r = [d + \vec{\omega} \times][d + \vec{\omega} \times] r$$

Non-Inertial

Inertial

$$= d^2 r + d[\vec{\omega} \times \vec{r}] + \vec{\omega} \times (dr) + \vec{\omega} \times \omega \times \vec{r}$$

$$= d^2 r + (d\vec{\omega}) \times \vec{r} + \vec{\omega} \times (d\vec{r}) + \vec{\omega} \times (dr) + \vec{\omega} \times \vec{\omega} \times \vec{r}$$

$$= d^2 r + \dot{\omega} \times r + 2\omega \times \dot{r} + \omega \times \omega \times r$$

Time-dep. ω — Coriolis $2\omega \times v$ — Centrifugal $\omega^2 r = \frac{v^2}{r}$