Contents

1 Non-inertial Reference Frame

- Inertial - No acceleration
- Non Inertial - Yes acceleration
  - Fictitious forces

2 Centripetal Forces

- Centripetal Acceleration - $a_c = v\omega$
- Angular Acceleration (Angular, Linear) - $R\omega^2 \leftrightarrows \frac{v^2}{R}$

2.1 Example

$$\begin{aligned} R &= 40\,\mathrm{m} \\ v &= 7\,\mathrm{m\,s^{-1}} \\ \mu_{min} &= ? \end{aligned}$$

$$\begin{aligned} \sum F_z &= 0 \\ N &= mg \end{aligned}$$

$$\begin{aligned} \sum F_c &= \frac{mv^2}{R} \\ f &= \frac{mv^2}{R} \\ \mu g &= \frac{v^2}{R} \\ \mu &= \frac{v^2}{gR} \\ \mu &= \frac{(7\,\mathrm{m\,s^{-1}})^2}{(10\,\mathrm{m\,s^{-2}})(40\,\mathrm{m})} \\ \mu &= 0.12 \end{aligned}$$

2.2 Example

$$
\begin{aligned}
R &= 10\,\mathrm{m} \\
\theta &= 36^\circ \\
\mu &= 0 \\
v &= 0
\end{aligned}
$$

$$
\begin{aligned}
\sum F_z &= 0 \\
N\sin(\theta) &= mg \\
N &= \frac{mg}{\cos(\theta)}
\end{aligned}
$$

$$
\begin{aligned}
\sum F_c &= ma_c \\
-f\cos(\theta) &= ma_c \\
-\mu mg\tan(\theta) + N\sin(\theta) &= \frac{mv^2}{R} \\
\left(\frac{mg}{\cos(\theta)}\right)\sin(\theta) &= \frac{mv^2}{R} \\
v &= \sqrt{Rg\tan(\theta)}
\end{aligned}
$$

2.3 Example

$$
\begin{aligned}
D &= 4\,\mathrm{m} \\
\mu_{max} &= 0.4 \\
\omega &= ? \\
m &= 60\,\mathrm{kg}
\end{aligned}
$$

$$
\begin{aligned}
\sum F_z^{(m)} &= 0 \\
f &= mg \\
\mu N &= mg \\
N &= \frac{mg}{\mu}
\end{aligned}
$$