Rolling, Gyroscopic couple: \( C = l6XQ_p \)
\[ = 320 \times 251.33 \times 0.15 = 12063.84 \text{ Nm} \]

During rolling, the ship rolls in the same plane as the plane of spin and there will be no gyroscopic effect.

1.5 Gyroscopic Effect on Aeroplane

Aeroplanes are subjected to gyroscopic effect when it taking off, landing and negotiating left or right turn in the air.

Let
\[ \omega = \text{Angular velocity of the engine rotating parts in rad/s}, \]
\[ m = \text{Mass of the engine and propeller in kg}, \]
\[ r_w = \text{Radius of gyration in m}, \]
\[ I = \text{Mass moment of inertia of engine and propeller in kg m}^2, \]
\[ V = \text{Linear velocity of the aeroplane in m/s}, \]
\[ R = \text{Radius of curvature in m}, \]
\[ \omega_p = \text{Angular velocity of precession} = \frac{V}{R} \text{ rad/s} \]

\[ \therefore \text{Gyroscopic couple acting on the airplane} = C = I \omega \omega_p \]

Let us analyze the effect of gyroscopic couple acting on the body of the aeroplane for various conditions.

Case (i): PROPELLER rotates in CLOCKWISE direction when seen from rear end and Aeroplane turns towards LEFT
According to the analysis, the reactive gyroscopic couple tends to dip the tail and raise the nose of aeroplane.

Case (ii): PROPELLER rotates in CLOCKWISE direction when seen from rear end and Aeroplane turns towards RIGHT.
According to the analysis, the reactive gyroscopic couple tends to raise the tail and dip the nose of the aeroplane.