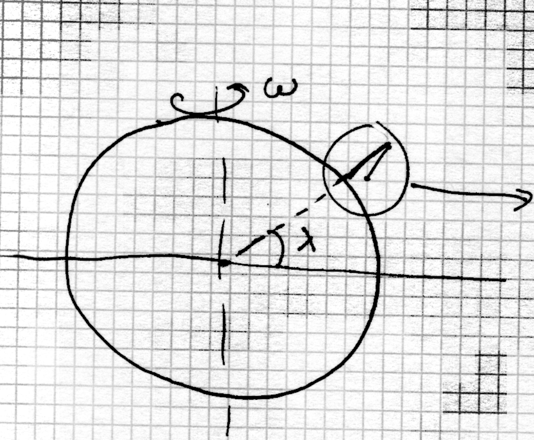
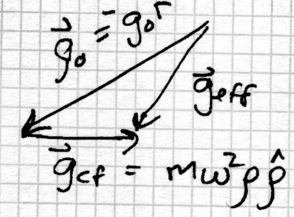
TM 10-12





- The plumb line will hang in the direction of the effective $\vec{g}$ vector, $\vec{g}_{eff} = \vec{g}_0 + \vec{g}_{cf}$

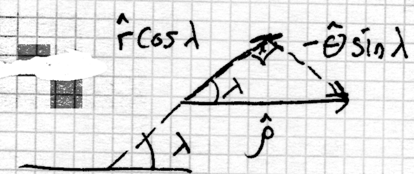
where $\vec{g}_0$ is the acceleration due to gravity in the absence of rotation,

$$\vec{g}_0 = -\hat{r}g_0$$

and $\vec{g}_{cf}$ is the centrifugal acceleration

$$\vec{g}_{cf} = \omega^2\rho\hat{\rho}$$

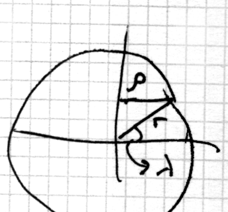
- write $\hat{\rho}$ in terms of $\hat{r}, \hat{\theta}$

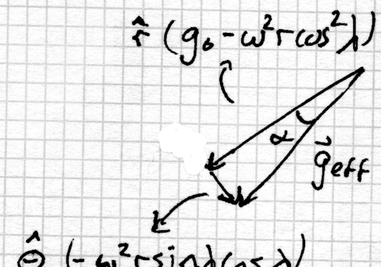


so:
$$\vec{g}_{eff} = -\hat{r}g_0 + m\omega^2\rho(\hat{r}\cos\lambda - \hat{\theta}\sin\lambda)$$
$$= \hat{r}(-g_0 + \omega^2\rho\cos\lambda) - \omega^2\rho\sin\lambda\,\hat{\theta}$$

and using $\rho = r\cos\lambda$ we have

$$\vec{g}_{eff} = \hat{r}(-g_0 + \omega^2 r\cos^2\lambda) - \hat{\theta}\,\omega^2 r\sin\lambda\cos\lambda$$





The angle of deflection is

$$\alpha = \tan^{-1}\left[\frac{\omega^2 r\sin\lambda\cos\lambda}{g_0 - \omega^2 r\cos^2\lambda}\right]$$

For α small,

$\tan\alpha \approx \alpha$, so

$$\boxed{\alpha \approx \frac{\omega^2 r\sin\lambda\cos\lambda}{g_0 - \omega^2 r\cos^2\lambda}}$$