Notes on Taylor's Tides Section PhL 1.20.17

Starts on his page 330 (pdf p 345).

9.2 The Tides

[330] ok

[331] arm waving argument not very convincing to me

[332] quickly gets the tidal force equation

$$\mathbf{F}_{\text{tid}} = -GM_{\text{m}}m\left(\frac{\hat{\mathbf{d}}}{d^2} - \frac{\hat{\mathbf{d}}_{\text{o}}}{d_{\text{o}}^2}\right) \qquad (9.12)$$

[333] the four arrows picture. Shape of surface. Claims

it follows that $m\mathbf{g} + \mathbf{F}_{\text{tid}}$ must likewise be normal to the surface.

He says both pieces are "conservative" forces. I goofed this up in my early doc "the tide potential calculation v2" and now fixed it up, but I never came up with a viable potential. Here Taylor is going to do it! His effort is similar to my normal calculation effort, takes 2 pages of algebra. He then gets the same 54 cm and 25 cm.

[334] his potential calc

[335] Results for height. Effect of land masses etc alters the theory. Neap and spring.

And so ends this tide section. I thought it was longer? Nope, that's it, all done. His next topic is the G Rule in this section

9.3 The Angular Velocity Vector

This section talks about the rotation cone that I draw a few times. Rotating frames and

$$\frac{d\mathbf{e}}{dt} = \boldsymbol{\omega} \times \mathbf{e}\,, \qquad (9.23)$$

9.4 Time Derivatives in a Rotating Frame

$$\left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}_0} = \text{(rate of change of vector } \mathbf{Q} \text{ relative to inertial frame } \mathcal{S}_0)$$

and

$$\left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}} = \text{(rate of change of same vector } \mathbf{Q} \text{ relative to rotating frame } \mathcal{S}).$$

He then gets the G Rule

$$\left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}_0} = \left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}} + \boldsymbol{\Omega} \times \mathbf{Q}. \qquad (9.30)$$

9.5 Newton's Second Law in a Rotating Frame

$$m\ddot{\mathbf{r}} = \mathbf{F} + 2m\dot{\mathbf{r}} \times \boldsymbol{\Omega} + m(\boldsymbol{\Omega} \times \mathbf{r}) \times \boldsymbol{\Omega}, \qquad (9.34)$$

9.6 The Centrifugal Force

9.7 The Coriolis Force

9.9 The Foucault Pendulum

9.10 Coriolis Force and Coriolis Acceleration

Taylor's 2005 book is good, well written and well organized. Preface says it is for use after you have already had a Freshman mechanics course, perhaps you are a Junior when you use his book.

Taylor never turns the rotation of the Earth on, so there are no plots of tides for latitudes as I have tried to do, so at least I have done something he has not done. He is a fan of Maple and such systems.