5/6 $\dfrac{v}{R-h}$, $\dfrac{\Delta\theta}{\Delta t}$

5/11 $T = \dfrac{2}{w_0 k}$, $\theta(T) - \theta(0) = \dfrac{1}{k}\log\left(w_0 k T + 1\right)$

$(\log(e) = 1)$ ← bas e.

5/19 $\vec{\omega} = \dfrac{v_A}{r}\hat{k}$, $\vec{\alpha} = -\dfrac{a_{B,t}}{r}\hat{k}$,

$\vec{a}_c = \vec{a}_{c,t} + \vec{a}_{c,n}$, $\vec{a}_{c,t} = -\dfrac{a_{B,t}}{\sqrt{2}}(\hat{i} + \hat{j})$,

$\vec{a}_{c,n} = \dfrac{v_A^2/r}{\sqrt{2}}(-\hat{i} + \hat{j})$

5/28 $w_B(T_2 - T_1) = \dfrac{A}{2}(T_2 - T_1) + \dfrac{B}{4}(T_2 - T_1)^2 + w_B(T_1)$

$\alpha_A(t) = A + Bt$, $T_2 = 6s$, $T_1 = 2s$,

$A = 4s^{-2}$, $B = 7s^{-3}$,

$w_B(T_1) = \dfrac{300 \cdot 2\pi}{60} s^{-1}$

5/36 $\dot{\vec{A}} = v_0\hat{i} + (\hat{i}\sin\theta + \hat{j}\cos\theta)v_0$

$\ddot{\vec{A}} = (\hat{i}\cos\theta - \hat{j}\sin\theta)r\omega^2$

5/41 $\dot{\theta} = -\dfrac{v}{x}\dfrac{r}{\sqrt{x^2 - r^2}}$

5/42
$$\dot{\theta} = \frac{hnw_0}{h^2+x^2}$$

5/46
$$v = \frac{2\sqrt{L^2+b^2-2Lb\cos\theta}}{L\tan\theta}\,\dot{s}$$

5/53
$$\dot{\beta} = \frac{\dot{\theta}}{2}\,\frac{\cos\theta - \frac{y}{z}}{\frac{y^2+z^2}{2yz} - \cos\theta}$$

5/61
$$\vec{V}_x = \vec{V} + \vec{\omega}\times\vec{R}_x \quad , \; x \in \{A, B, C, D\}$$

5/70
$$V_0 = \frac{V_A}{\sqrt{2}} \quad , \; \omega = \frac{V_0}{R}$$

Rita bild!

5/73
$$\omega = \frac{v}{L\left(\frac{\cos\beta}{\sqrt{3}} + \sin\beta\right)} \quad , \; V_B = \frac{2}{\sqrt{3}}\,\omega L\cos\beta$$

β är lutning på stav från horisontalplanet.

5/77
$$\vec{V}_B = \frac{w_0 r \sin(\theta)}{\sin(\varphi)}\left(\sin(\varphi)\,\hat{i} + \cos(\varphi)\,\hat{j}\right)$$

$$\vec{\omega}_{AB} = \frac{w_0}{2}\left(\frac{\sin(\theta)}{\sin(\varphi)}\cos(\varphi) + \cos(\theta)\right) \quad , \; \theta = \frac{\pi}{4} \quad , \; \varphi = \frac{\pi}{6}$$

5/100 $\vec{v}_A = \frac{\omega L}{2\sqrt{2}}\hat{i}$, $\vec{v}_P = -\frac{\omega L}{\sqrt{2}}\hat{j} - \frac{\omega L}{2\sqrt{2}}\hat{i}$

5/109 $v = \omega(R-h)$, $v_S = \omega h$

5/120 a) $\omega_B = 4\omega_{OA}$ b) $\omega_B = 4\omega_{OA} + 3\omega_D$

5/123) $\vec{a}_A = a_0\hat{i} + \omega^2 r(-\cos\theta\,\hat{i} - \sin\theta\,\hat{j})$

5/128) $\vec{a}_B = -\omega_2^2 R_2\,\hat{i} + \omega_1^2 R_1\,\hat{i}$

Jordens rot. runt solen

Jordens rot. runt egen axel

5/137) $\vec{a}_x = \vec{a}_0 + \vec{\omega}\times(\vec{\omega}\times\vec{r}_{x/0}) + \vec{\alpha}\times\vec{r}_{x/0}$

$\vec{a}_A = -a_0\left(1+\frac{r_2}{r_1}\right)\hat{i} - \frac{v_0^2}{r_1}\frac{r_2}{r_1}\hat{j}$

D: liknande procedur...

5/159 $\vec{v}_A = -\omega y_A\hat{i} + (\omega x_A + \dot{y}_A)\hat{j}$

$\vec{a}_A = (\alpha y_A - \omega^2 x_A - 2\omega\dot{y}_A)\hat{i} + (-\alpha x_A - \omega^2 y_A + \ddot{y}_A)\hat{j}$

5/163) $\vec{a}_{cor} = 2\omega v\sin\theta\,\hat{i}$ a) 0 b) $2\omega v$

5/164 $\vec{v}_{rel} = -\Omega d\,\hat{j}$

5/177) $\vec{v}_{rel} = -v\left(2 - \frac{L}{\sqrt{2}r}\right)\hat{\xi} - \frac{vL}{\sqrt{2}r}\hat{\eta}$, $L = 127m$
$r = 60m$

$\vec{a}_{rel}$: Liknande procedur...

5/182) $\omega_{BC} = \frac{1}{2}\omega_{AO}$
$\vec{a}_{rel} = -\frac{1}{2} r \omega_{OA}^2 \cos(\theta)\hat{\eta}$

6/5) $a = g\tan\theta$, $\theta = 15\cdot\frac{\pi}{180}$ rad

6/7) $P = mg\frac{c}{b}$

6/14) a) $N_A = \frac{L_B}{L_A+L_B}mg$, $N_B = \frac{L_A}{L_A+L_B}mg$, $L_A = 1{,}1\,m$, $L_B = 1{,}65\,m$

b) $N_A = \frac{\mu h + L_B}{L_A + L_B}mg$, $N_B = \frac{-\mu h + L_A}{L_A + L_B}mg$, $\mu = 0{,}9$, $h = 0{,}6\,m$

6/17) $F = \frac{mv^2(h_G - h_A)}{2sL_{AG}}$, $v = 60\,km/h$, $h_G = 0{,}9\,m$, $s = 30\,m$, $L_{AG} = 1{,}2\,m$, $h_A = 0{,}5\,m$

6/22) $M = \frac{ml}{2}\left(g + \sin\theta\left(\frac{F}{M} - g\sin\theta\right)\right)$

6/33) $R = \frac{mg}{4}$

6/45) $\alpha = \frac{7g}{18b}$

6/54) $x = \frac{l}{2\sqrt{3}}$, $\alpha = \frac{\sqrt{3}g}{l}$

6/65) $\alpha = \frac{\mu_k P r_B}{(\cos\theta - \mu_k\sin\theta)mr_g^2}$, $T = \frac{\omega_A r_A}{r_B\alpha}$

6/69) a) $\mu_s = \frac{1}{2}\frac{\sin\theta}{5\cos\theta - 3}$, $\theta = \frac{\pi}{6}$ b) $\cos\theta = \frac{3}{5}$

6/72) $\vec{a}_A = \frac{P}{10m}(37\hat{i} + 9\hat{j})$

6/88 $\vec{\alpha} = -\dfrac{\mu m g R - r T}{\bar{k}^2 m}\hat{k}$, $\vec{a} = \dfrac{T - \mu m g}{m}\hat{i}$,

$F = \mu m g$, $\mu = \dfrac{r R T + \bar{k}^2 T}{m g (R^2 + \bar{k}^2)}$

6/97 $\vec{a}_A = -\frac{3}{2} g \sin\theta \cos\theta \dfrac{1}{(1 + \frac{3}{2}\mu_k \cos\theta \sin\theta)}\hat{i}$

6/114 $\cos\theta = 1 - \dfrac{v^2}{2gL}$

6/118 $\omega = \sqrt{\dfrac{4sF}{(2M + \frac{16m}{3})l^2}}$, $s = 3m$, $M = 10kg$, $m = 2kg$, $l = 0{,}3m$, $F = 40N$

6/124 $V_A = \sqrt{6gb\sin\left(\frac{\theta}{2}\right)}$

6/143 $v = \sqrt{gL_2 - k\dfrac{L_1^2}{2m}}$, $L_1 = 2{,}4m$, $L_2 = 3m$, $k = 700 N/m$

6/169 $H = \dfrac{2\pi m R^2}{T}$, $R = 149{,}6 \cdot 10^9 m$, $T = 365{,}26 \cdot 24 \cdot 3600 s$

6/170 $\omega = \dfrac{F(R+r) - mgr\sin\theta}{(\bar{k}^2 + r^2)m}T$, $R = 0{,}25m$, $r = 0{,}15m$, $T = 8s$

6/188 $T = \dfrac{v_0/g}{\frac{7}{2}\mu_k\cos\theta - \sin\theta}$, $\omega(T) = \dfrac{5\mu_k v_0}{2r}\dfrac{1}{\frac{7}{2}\mu_k - \tan\theta}$

$v(T) = r\omega(T)$

7/9 $\vec{\omega} = \omega_0 \hat{k} + p\hat{\eta}$, $\vec{\alpha} = p\dot{\hat{\eta}} = -p\omega_0 \hat{\xi}$

7/10 $\vec{\alpha} = -\omega_0 \Omega \hat{\xi}$, $\vec{a}_P = -\omega_0^2 r_2 \hat{k} + (2\omega_0 \Omega r_2 - \Omega^2 r_1)\hat{\eta}$

$r_1 = 0{,}45\,m + 0{,}4\,m$, $r_2 = 0{,}5\,m$

7/14 $\vec{\omega} = -\Omega \cos\gamma\, \hat{i} + (\omega_p + \Omega \sin\gamma)\hat{k}$

$\vec{\alpha} = \omega_p \Omega \cos\gamma\, \hat{j}$

7/18 $\vec{\alpha} = -\left(\frac{2\pi}{\tau}\right)^2 \frac{R}{r} \hat{\xi}$

7/26 $\alpha = \frac{R}{r}\left(\frac{2\pi}{\tau}\right)^2 \cos\theta$, $\theta = \frac{\pi}{4} - \arcsin\left(\frac{\sqrt{2}}{6}\right)$,

$R = 150\,mm$, $r = 50\,mm$

7/31 $\omega = \sqrt{\Omega^2 + p^2}$, $\vec{\alpha} = -p\Omega\hat{\eta}$

7/37 $\vec{v}_A = v_y \hat{j} - \omega_y r \hat{k}$, $\vec{a}_A = -\omega_y^2 r \hat{i} + (a_y + \omega_x \omega_y r)\hat{j} - \alpha_y r \hat{k}$

7/47 $\vec{\omega} = \dot{\theta}\Omega\hat{\xi}$

$$\vec{a}_A = (\Omega^2 l \sin\theta + \dot{\theta}^2 l \sin\theta)\hat{\xi} - (2\Omega\dot{\theta} l \cos\theta + \Omega^2 L)\hat{\eta} - \dot{\theta}^2 l \cos\theta\, \hat{k}$$

, $l = 0{,}6\,m$, $L = 2{,}4\,m$

7/53) $\vec{P} = mb\omega\hat{\xi} - mb\omega\hat{\eta}$

$\vec{L} = mb^2\omega(-\hat{\xi} - 2\hat{\eta} + 2\hat{\zeta})$

7/58 $\vec{L} = \frac{1}{3}\omega m l^2 \sin\theta(\sin\theta\, \hat{j} - \cos\theta\, \hat{k})$

7/61 $\vec{L} = \bar{I} p(\hat{i}+\hat{j}+\hat{k}) + 2(\bar{I} + mb^2)(\Omega_x \hat{i} + \Omega_y \hat{j} + \Omega_z \hat{k})$

7/71 $\vec{L} = \left(\frac{2}{5} mr^2 + 2mb^2 + \frac{1}{3} mc^2 \cos^2\beta\right) \omega \hat{k}$
$+ \frac{1}{6} mc^2 \sin(2\beta) \omega \hat{j}$

7/72 $\vec{L} = m\omega\left(a^2 + ac + \frac{c^2}{3} + \frac{b^2}{3}\cos^2\theta\right)\hat{k}$
$+ \frac{m\omega b^2}{6} \sin(2\theta)\, \hat{i}$

7/75 $\vec{F}_B = \frac{mbl\omega^2}{2c}(\cos\theta\, \hat{i} + \sin\theta\, \hat{j})$

7/78 $F_B = \frac{dam\omega^2}{b}$, $F_A = \frac{d(a+b)m\omega^2}{b}$

7/81 $\alpha = \frac{M}{\cos^2\theta\, I_0 + \sin^2\theta\, I}$

7/86 $\vec{M} = \frac{1}{8} mr^2 \sin(2\alpha)\, \omega^2 \hat{j}$

7/91 $\omega = \sqrt{\frac{12g}{l\sqrt{3}}}$

7/99 $b + \Delta b = b + \frac{M\bar{k}^2 \Omega \omega}{mg}$

7/105 $M = m\bar{k}^2 \Omega \dot{\theta}$, ccw

7/111 $\dot{\psi} = \frac{2I_0\, p}{(I_0 - 2I_0)\cdot 1}$

7/113 $F_A = \frac{Mg}{2} - \Delta F$, $F_B = \frac{Mg}{2} + \Delta F$, $\Delta F = \frac{mk^2 \Omega p}{2l}$, $m = 2{,}5\,kg$, $M = 10\,kg$, $l = 0{,}12\,m$

7/120 $\tau = \frac{3\pi \cos\theta}{p}$, $\theta = \frac{\pi}{18}$

7/129 $p = \frac{muh}{m_0 k^2}$

8/7 $\quad f_n = \frac{1}{2\pi}\sqrt{\frac{k_1+k_2}{m}} \approx 7,4 \text{ rev } s^{-1}$

8/14 $\quad m = k\left(\frac{\tau}{2\pi}\right)^2 - M \quad , \mu_s \geq \frac{A\omega_n^2}{g}$

$M = 6 \text{ kg} \quad , \quad A = 0,05 \text{ m} \quad , \quad \omega_n = \sqrt{\frac{k}{M+m}}$

8/23 $\quad \omega_n = \sqrt{\frac{k}{5m}}$

8/29 $\quad c = 2\sqrt{km} \approx 2049 \text{ kg/s}$ Note! Error in Meriam & Kraige

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8/31 $\quad \zeta = \frac{\delta}{\sqrt{\delta^2 + (2\pi N)^2}}$

8/37 $\quad (\dot{x}_0)_c = -\omega_n x_0$

8/45 $\quad X = \frac{F_0/k}{\sqrt{\left(1-\left(\frac{\omega}{\omega_n}\right)^2\right)^2 + \left(2\zeta\frac{\omega}{\omega_n}\right)^2}} \quad , \quad \zeta = \frac{c}{2m\omega_n} ,$

$\omega_n = \sqrt{\frac{k}{m}}$

8/47 $\quad \frac{F_0^2}{m^2X^2} = \omega_n^4 - 2\omega_n^2\omega^2 + \omega^4 + 4\zeta^2\omega_n^2\omega^2$

$\Rightarrow 6,864 s^{-1} < \omega \quad , \quad 4,99 s^{-1} > \omega$

8/55 $\quad |X| = \frac{\omega_n^2 d}{\omega_n^2 - \omega^2} \quad , d = 0,003 \text{ mm}$

8/59 $\quad \frac{1}{2\pi}\frac{1}{\sqrt{3}}\sqrt{\frac{4k}{m}} < f < \frac{1}{2\pi}\sqrt{\frac{5}{3}}\sqrt{\frac{4k}{m}}$

8/61 $\quad \omega_n = \sqrt{\frac{k}{m}} \quad , \quad \zeta = \frac{c_1+c_2}{2\sqrt{mk}} \quad , \quad \omega_c = \omega_n\sqrt{1-2\zeta^2} = \omega_n(1-\zeta^2+\dots)$

$\zeta \ll 1$ för att kunna ha resonans.

8/74 $f_n = \frac{1}{\pi}\sqrt{\frac{2g}{3\pi r}}$, $r_{CM} = -\frac{4r}{3\pi}$, $I_0 = \frac{1}{2}mr^2$

8/76 $\tau = 2\pi\sqrt{\frac{5b}{6g}}$

8/77 $\omega_n = \frac{3}{2}\sqrt{\frac{g}{2b}}$

8/80 $\frac{\tau_B}{\tau_A} = \sqrt{\frac{I_B}{I_A}} = 2/\sqrt{3}$

8/83 $f_n = \frac{b}{2\pi l}\sqrt{\frac{k}{m}}$

8/91 $\tau = 2\pi\sqrt{\frac{3(R-r)}{2g}}$, $\omega_{max} = \frac{\theta_0}{r}\sqrt{\frac{2g(R-r)}{3}}$

8/93 $\Theta = -\frac{\frac{3b}{2l}\omega^2}{\omega_n^2 - \omega^2}$, $\omega_n^2 = \frac{K - mgl/2}{\frac{1}{3}ml^2}$