File S1 $m_{\mathrm{w}}(z)$, $m_{\mathrm{B}}(z)$, W_{A}, W_{P}, W_{B}, Q_{hA}, Q_{vA}, $Q_{\mathrm{hA}}(t)$, $Q_{\mathrm{vA}}(t)$, Q_{hP}, Q_{vP}, $Q_{\mathrm{hP}}(t)$, $Q_{\mathrm{vP}}(t)$, Q_{hB}, Q_{vB}, $Q_{\mathrm{hB}}(t)$, $Q_{\mathrm{vB}}(t)$, C_{A}, C_{P}, C_{B}, C_{AP}, C_{PB}, for the four cases ($m_w(z)$ can be divided into $m_{\mathrm{A}}(z)$ and $m_{\mathrm{P}}(z)$)

Case 1: $H\cot\beta < H_{\mathrm{T}}\cot\xi$

$H_{\mathrm{P11}} = H_T - H\cot\beta\tan\xi$, $H_{\mathrm{A2}} = H\cot\beta\tan\xi$, $H_{\mathrm{A1}} = H + H_{\mathrm{A2}}$, $H_{\mathrm{P4}} = H + H_T$,

$H_{\mathrm{B1}} = H_B\cot\alpha\tan\eta$, $H_{\mathrm{B2}} = H_B(1+\cot\alpha\tan\eta)$,

$H_{\mathrm{P3}} = [H_{\mathrm{A1}} - H_{\mathrm{B2}} + (B_T - H\cot\beta + H_T\cot\xi)\tan\eta] / (\cot\theta\tan\eta - 1)$, $H_{\mathrm{A}} = H_{\mathrm{A1}} + H_{\mathrm{P3}}$,

$H_{\mathrm{P2}} = H_{\mathrm{B2}} - H_{\mathrm{P3}}$, $H_{\mathrm{P1}} = H_{\mathrm{P4}} - H_{\mathrm{P2}}$, $H_{\mathrm{P}} = H_{\mathrm{P4}} + H_{\mathrm{P3}}$;

$C_P = c_P H_{\mathrm{P3}} / \sin\theta$, $C_{\mathrm{AP}} = cH_{\mathrm{A1}}$, $C_{\mathrm{PB}} = cH_{\mathrm{B2}}$;

$m_{\mathrm{A1}}(z) = \rho z\cot\xi$ ($0 \le z < H_{\mathrm{A2}}$), $m_{\mathrm{A2}}(z) = \rho\left(H_{\mathrm{A1}} - z\right)\cot\beta$ ($H_{\mathrm{A2}} \le z \le H_{\mathrm{A1}}$);

$W_A = W_{\mathrm{A1}} + W_{\mathrm{A2}}$, $W_{\mathrm{A1}} = 0.5\gamma HH_{\mathrm{A2}}\cot\beta$, $W_{\mathrm{A2}} = 0.5\gamma H^2\cot\beta$; $Q_{\mathrm{hA}} = k_{\mathrm{h}}W_A$;

$Q_{\mathrm{hA}}(t) = Q_{\mathrm{hA1}} + Q_{\mathrm{hA2}}$,

$Q_{\mathrm{hA1}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}}\cot\xi)(-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{A2}}\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - (TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - \sin2\pi(t/T - H_{\mathrm{A}}/TV_{\mathrm{s}})]\} + [(1-f_{\mathrm{a}})\cot\xi / H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A2}}^2\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - (TV_{\mathrm{s}}/\pi)[H_{\mathrm{A2}}\sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) + (TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - \cos2\pi(t/T - H_{\mathrm{A}}/TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hA2}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}}H_{\mathrm{A1}}\cot\beta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - \cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}})] + [(1-f_{\mathrm{a}})H_{\mathrm{A1}}\cot\beta / H_{\mathrm{A}} - f_{\mathrm{a}}\cot\beta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A1}}\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - H_{\mathrm{A2}}\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - (TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - \sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}})]\} + [(f_{\mathrm{a}} - 1)\cdot\cot\beta / H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A1}}^2\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - H_{\mathrm{A2}}^2\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) - (TV_{\mathrm{s}}/\pi)[H_{\mathrm{A1}}\sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - H_{\mathrm{A2}}\sin2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}) + (TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A1}})/TV_{\mathrm{s}}) - \cos2\pi(t/T - (H_{\mathrm{A}} - H_{\mathrm{A2}})/TV_{\mathrm{s}}))]\}$,

$m_{\mathrm{P1}}(z) = \rho[B_T + z(\cot\eta + \cot\xi)]$ ($0 \le z < H_{\mathrm{P11}}$),

$m_{\mathrm{P2}}(z) = \rho(B_T + H_{\mathrm{P11}}\cot\xi + z\cot\eta)$ ($H_{\mathrm{P11}} \le z < H_{\mathrm{P1}}$),

$m_{\mathrm{P3}}(z) = \rho H_{\mathrm{P3}}\cot\theta$ ($H_{\mathrm{P1}} \le z < H_{\mathrm{P4}}$), $m_{\mathrm{P4}}(z) = \rho\left(H_{\mathrm{P}} - z\right)\cot\theta$ ($H_{\mathrm{P4}} \le z \le H_{\mathrm{P}}$);

$W_P = W_{\mathrm{P1}} + W_{\mathrm{P2}} + W_{\mathrm{P3}} + W_{\mathrm{P4}}$, $W_{\mathrm{P1}} = \gamma[H_{\mathrm{P11}}B_T + 0.5H_{\mathrm{P11}}^2(\cot\eta + \cot\xi)]$,

$W_{\mathrm{P2}} = \gamma(H_{\mathrm{P1}} - H_{\mathrm{P11}})[B_T + H_{\mathrm{P11}}\cot\xi + 0.5(H_{\mathrm{P1}} - H_{\mathrm{P11}})\cot\eta]$, $W_{\mathrm{P3}} = \gamma H_{\mathrm{P2}}H_{\mathrm{P3}}\cot\theta$,

$W_{\mathrm{P4}} = 0.5\gamma H_{\mathrm{P3}}^2 \cot\theta$; $Q_{\mathrm{hP}} = k_{\mathrm{h}} W_P$; $Q_{\mathrm{hP}}(t) = Q_{\mathrm{hP1}} + Q_{\mathrm{hP2}} + Q_{\mathrm{hP3}}$,

$Q_{\mathrm{hP1}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}} B_T)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T - H_{\mathrm{P}} / TV_{\mathrm{s}})] + [f_{\mathrm{a}}(\cot\eta + \cot\xi)$
$+(1 - f_{\mathrm{a}}) B_{\mathrm{T}} / H_{\mathrm{P}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P11}} \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}})$
$/TV_{\mathrm{s}}) - \sin 2\pi(t / T - H_{\mathrm{P}} / TV_{\mathrm{s}})]\} + [(1 - f_{\mathrm{a}})(\cot\eta + \cot\xi) / H_{\mathrm{P}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P11}}^2 \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}})$
$/TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / \pi)[H_{\mathrm{P11}} \sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) + (TV_{\mathrm{s}} / 2\pi)(\cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) - \cos 2\pi$
$\cdot(t / T - H_{\mathrm{P}} / TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hp2}} / k_{\mathrm{h}}\gamma = f_{\mathrm{a}}(B_{\mathrm{T}} + H_{\mathrm{P11}} \cot\xi)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}})]$
$+[f_{\mathrm{a}} \cot\eta + (1 - f_{\mathrm{a}})(B_{\mathrm{T}} + H_{\mathrm{P11}} \cot\xi) / H_{\mathrm{P}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P1}} \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - H_{\mathrm{P11}} \cos 2\pi(t / T - (H_{\mathrm{P}}$
$-H_{\mathrm{P11}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - \sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}})]\} + [(1 - f_{\mathrm{a}}) \cot\eta / H_{\mathrm{P}}]$
$(-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P1}}^2 \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - H_{\mathrm{P11}}^2 \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / \pi)[H_{\mathrm{P1}} \sin 2\pi(t / T$
$-(H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - H_{\mathrm{P11}} \sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}) + (TV_{\mathrm{s}} / 2\pi)(\cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T$
$-(H_{\mathrm{P}} - H_{\mathrm{P11}}) / TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hp3}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}} H_{\mathrm{P3}} \cot\theta)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}})]$
$+[(1 - f_{\mathrm{a}})(H_{\mathrm{P3}} \cot\theta) / H_{\mathrm{P}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P4}} \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}) - H_{\mathrm{P1}} \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) /$
$TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}) - \sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P1}}) / TV_{\mathrm{s}})]\}$,

$Q_{\mathrm{hp4}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}} H_{\mathrm{P}} \cot\theta)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T) - \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}})] + [(1 - f_{\mathrm{a}})(H_{\mathrm{P}} \cot\theta) / H_{\mathrm{P}}$
$-f_{\mathrm{a}} \cot\theta](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P}} \cos 2\pi(t / T) - H_{\mathrm{P4}} \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T) - \sin 2\pi$
$(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}})]\} + [(f_{\mathrm{a}} - 1)\cot\theta / H_{\mathrm{P}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{P}}^2 \cos 2\pi(t / T) - H_{\mathrm{P4}}^2 \cos 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}})$
$/TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / \pi)[H_{\mathrm{P}} \sin 2\pi(t / T) - H_{\mathrm{P4}} \sin 2\pi(t / T - (H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}) + (TV_{\mathrm{s}} / 2\pi)(\cos 2\pi(t / T) - \cos 2\pi(t / T$
$-(H_{\mathrm{P}} - H_{\mathrm{P4}}) / TV_{\mathrm{s}}))]\}$.

Case 2: $H_{\mathrm{T}} \cot\xi \le H \cot\beta < B_{\mathrm{T}} + H_{\mathrm{T}} \cot\xi$

$H_{\mathrm{A1}} = H + H_T$, $H_{\mathrm{P4}} = H_{\mathrm{A1}}$, $H_{\mathrm{B1}} = H_B \cot\alpha \tan\eta$, $H_{\mathrm{B2}} = H_B(1 + \cot\alpha \tan\eta)$,

$H_{\mathrm{P3}} = [H_{\mathrm{A1}} - H_{\mathrm{B2}} + (B_{\mathrm{T}} - H\cot\beta + H_T \cot\xi)\tan\eta] / (\cot\theta \tan\eta - 1)$, $H_{\mathrm{A}} = H_{\mathrm{A1}} + H_{\mathrm{P3}}$,

$H_{\mathrm{P2}} = H_{\mathrm{B2}} - H_{\mathrm{P3}}$, $H_{\mathrm{P1}} = H_{\mathrm{P4}} - H_{\mathrm{P2}}$, $H_{\mathrm{P}} = H_{\mathrm{P4}} + H_{\mathrm{P3}}$;

$C_P = c_P H_{\mathrm{P3}} / \sin\theta$, $C_{\mathrm{AP}} = cH_{\mathrm{P4}}$, $C_{\mathrm{PB}} = cH_{\mathrm{B2}}$;

$m_{\mathrm{A1}}(z) = \rho(H\cot\beta - H_T \cot\xi + z\cot\xi)$ ($0 \le z < H_T$), $m_{\mathrm{A2}}(z) = \rho(H_{\mathrm{A1}} - z)\cot\beta$ ($H_T \le z \le H_{\mathrm{A1}}$);

$W_A = W_{\mathrm{A1}} + W_{\mathrm{A2}}$, $W_{\mathrm{A1}} = \gamma H_T(H\cot\beta - 0.5H_T \cot\xi)$, $W_{\mathrm{A2}} = 0.5\gamma H^2 \cot\beta$; $Q_{\mathrm{hA}} = k_{\mathrm{h}} W_A$;

$Q_{\mathrm{hA}}(t) = Q_{\mathrm{hA1}} + Q_{\mathrm{hA2}}$,

$Q_{\mathrm{hA1}} / k_{\mathrm{h}}\gamma = f_{\mathrm{a}}(H\cot\beta - H_T \cot\xi)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T - (H_{\mathrm{A}} - H_{\mathrm{T}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T - H_{\mathrm{A}} / TV_{\mathrm{s}})] + [f_{\mathrm{a}} \cot\xi$
$+(1 - f_{\mathrm{a}})(H\cot\beta - H_T \cot\xi) / H_{\mathrm{A}}](-TV_{\mathrm{s}} / 2\pi)\{H_T \cos 2\pi(t / T - (H_{\mathrm{A}} - H_{\mathrm{T}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T - (H_{\mathrm{A}}$
$-H_{\mathrm{T}}) / TV_{\mathrm{s}}) - \sin 2\pi(t / T - H_{\mathrm{A}} / TV_{\mathrm{s}})]\} + [(1 - f_{\mathrm{a}})\cot\xi / H_{\mathrm{A}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{T}}^2 \cos 2\pi(t / T - (H_{\mathrm{A}} - H_{\mathrm{T}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}}$
$/\pi)[H_T \sin 2\pi(t / T - (H_{\mathrm{A}} - H_{\mathrm{T}}) / TV_{\mathrm{s}}) + (TV_{\mathrm{s}} / 2\pi)(\cos 2\pi(t / T - (H_{\mathrm{A}} - H_{\mathrm{T}}) / TV_{\mathrm{s}}) - \cos 2\pi(t / T - H_{\mathrm{A}} / TV_{\mathrm{s}}))]\}$,

$$Q_{\mathrm{hA2}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{A1}}\cot\beta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})]$$
$$+[(1-f_{\mathrm{a}})H_{\mathrm{A1}}\cot\beta H_{\mathrm{A}}-f_{\mathrm{a}}\cot\beta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A1}}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-H_T\cos2\pi(t/T-(H_{\mathrm{A}}$$
$$-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)$$
$$\cdot\cot\beta/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A1}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-H_{\mathrm{T}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}$$
$$/\pi)[H_{\mathrm{A1}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-H_T\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-$$
$$(H_{\mathrm{A}}-H_{\mathrm{A1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}}))]\},$$

$$m_{\mathrm{P1}}(z)=\rho(B_{\mathrm{T}}-H\cot\beta+H_{\mathrm{T}}\cot\xi+z\cot\eta)\ (0\le z<H_{\mathrm{P1}}),\quad m_{\mathrm{P2}}(z)=\rho H_{\mathrm{P3}}\cot\theta\ (H_{\mathrm{P1}}\le z<H_{\mathrm{P4}}),$$

$$m_{\mathrm{P3}}(z)=\rho(H_{\mathrm{P}}-z)\cot\theta\ (H_{\mathrm{P4}}\le z\le H_{\mathrm{P}});$$

$$W_P=W_{\mathrm{P1}}+W_{\mathrm{P2}}+W_{\mathrm{P3}},\ W_{\mathrm{P1}}=\gamma[H_{\mathrm{P1}}(B_{\mathrm{T}}-H\cot\beta+H_{\mathrm{T}}\cot\xi)+0.5H_{\mathrm{P1}}^2\cot\eta],\ W_{\mathrm{P2}}=\gamma H_{\mathrm{P2}}H_{\mathrm{P3}}\cot\theta,$$

$$W_{\mathrm{P3}}=0.5\gamma H_{\mathrm{P3}}^2\cot\theta;\ Q_{\mathrm{hP}}=k_{\mathrm{h}}W_P;\ Q_{\mathrm{hP}}(t)=Q_{\mathrm{hP1}}+Q_{\mathrm{hP2}}+Q_{\mathrm{hP3}},$$

$$Q_{\mathrm{hP1}}/k_{\mathrm{h}}\gamma=f_{\mathrm{a}}(B_{\mathrm{T}}-H\cot\beta+H_T\cot\xi)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{P}}/$$
$$TV_{\mathrm{s}})]+[f_{\mathrm{a}}\cot\eta+(1-f_{\mathrm{a}})(B_{\mathrm{T}}-H\cot\beta+H_{\mathrm{T}}\cot\xi)/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P1}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})$$
$$-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})\cot\eta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)$$
$$\{H_{\mathrm{P1}}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{P1}}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi$$
$$(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}}))]\},$$
$$Q_{\mathrm{hP2}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P3}}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})]$$
$$+[(1-f_{\mathrm{a}})(H_{\mathrm{P3}}\cot\theta)/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P4}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-H_{\mathrm{P1}}\cos2\pi(t/T-(H_{\mathrm{P}}-$$
$$H_{\mathrm{P1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})]\},$$
$$Q_{\mathrm{hP3}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P}}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T)-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})(H_{\mathrm{P}}$$
$$\cot\theta)/H_{\mathrm{P}}-f_{\mathrm{a}}\cot\theta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}}\cos2\pi(t/T)-H_{\mathrm{P4}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)$$
$$[\sin2\pi(t/T)-\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)\cot\theta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}}^2\cos2\pi(t/T)$$
$$-H_{\mathrm{P4}}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{P}}\sin2\pi(t/T)-H_{\mathrm{P4}}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/$$
$$TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T)-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}}))]\}.$$

Case 3: $B_{\mathrm{T}}+H_{\mathrm{T}}\cot\xi\le H\cot\beta\le H_{\mathrm{T}}(\cot\xi+\cot\eta)$

$$H_{\mathrm{A1}}=(H\cot\beta-H_{\mathrm{T}}\cot\xi-B_{\mathrm{T}})\tan\eta,\ H_{\mathrm{A3}}=H_{\mathrm{T}}+H,\ H_{\mathrm{A2}}=H_{\mathrm{T}}-H_{\mathrm{A1}},\ H_{\mathrm{P4}}=H_{\mathrm{A2}}+H,$$

$$H_{\mathrm{B1}}=H_B\cot\alpha\tan\eta,\ H_{\mathrm{B2}}=H_B(1+\cot\alpha\tan\eta),\ H_{\mathrm{P3}}=(H_{\mathrm{P4}}-H_{\mathrm{B2}})/(\cot\theta\tan\eta-1),$$

$$H_{\mathrm{A}}=H_{\mathrm{A3}}+H_{\mathrm{P3}},\ H_{\mathrm{P2}}=H_{\mathrm{B2}}-H_{\mathrm{P3}},\ H_{\mathrm{P1}}=H_{\mathrm{P4}}-H_{\mathrm{P2}},\ H_{\mathrm{P}}=H_{\mathrm{P4}}+H_{\mathrm{P3}};$$

$$C_P=c_PH_{\mathrm{P3}}/\sin\theta,\ C_{\mathrm{AP}}=cH_{\mathrm{P4}},\ C_{\mathrm{PB}}=cH_{\mathrm{B2}};$$

$$m_{\mathrm{A1}}(z)=\rho[B_{\mathrm{T}}+z(\cot\eta+\cot\xi)]\ (0\le z<H_{\mathrm{A1}}),$$

$$m_{\mathrm{A2}}(z)=\rho(B_{\mathrm{T}}+H_{\mathrm{A1}}\cot\eta+z\cot\xi)\ (H_{\mathrm{A1}}\le z<H_{\mathrm{T}}),\ m_{\mathrm{A3}}(z)=\rho(H_{\mathrm{A3}}-z)\cot\beta\ \ (H_{\mathrm{T}}\le z\le H_{\mathrm{A3}});$$

$$W_A=W_{\mathrm{A1}}+W_{\mathrm{A2}}+W_{\mathrm{A3}},\ W_{\mathrm{A1}}=\gamma[B_TH_{\mathrm{A1}}+0.5H_{\mathrm{A1}}^2(\cot\eta+\cot\xi)],$$

$W_{\mathrm{A}2}=0.5\gamma H_{\mathrm{A}2}[2B_{\mathrm{T}}+H_{\mathrm{A}1}(2\cot\eta+\cot\xi)+H_{\mathrm{T}}\cot\xi]$, $W_{\mathrm{A}3}=0.5\gamma H^2\cot\beta$; $Q_{\mathrm{hA}}=k_{\mathrm{h}}W_A$;

$Q_{\mathrm{hA}}(t)=Q_{\mathrm{hA}1}+Q_{\mathrm{hA}2}+Q_{\mathrm{hA}3}$,

$Q_{\mathrm{hA}1}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}B_{\mathrm{T}})(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}})]+[f_{\mathrm{a}}(\cot\eta+\cot\xi)+(1-f_{\mathrm{a}})B_{\mathrm{T}}/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A}1}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})(\cot\eta+\cot\xi)/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A}1}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{A}1}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hA}2}/k_{\mathrm{h}}\gamma=f_{\mathrm{a}}(B_{\mathrm{T}}+H_{\mathrm{A}1}\cot\eta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})]+[f_{\mathrm{a}}\cot\xi+(1-f_{\mathrm{a}})(B_{\mathrm{T}}+H_{\mathrm{A}1}\cot\eta)/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_T\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-H_{\mathrm{A}1}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})\cot\xi/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{T}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-H_{\mathrm{A}1}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{T}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-H_{\mathrm{A}1}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}1})/TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hA}3}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{A}3}\cot\beta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})H_{\mathrm{A}3}\cot\beta/H_{\mathrm{A}}-f_{\mathrm{a}}\cot\beta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A}3}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-H_{\mathrm{T}}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)\cot\beta/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A}3}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-H_{\mathrm{T}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{A}3}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-H_{\mathrm{T}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A}3})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}}))]\}$.

$m_{\mathrm{P}1}(z)=\rho z\cot\eta$ $(0\le z<H_{\mathrm{P}1})$, $m_{\mathrm{P}2}(z)=\rho H_{\mathrm{P}3}\cot\theta$ $(H_{\mathrm{P}1}\le z<H_{\mathrm{P}4})$,

$m_{\mathrm{P}3}(z)=\rho(H_{\mathrm{P}}-z)\cot\theta$ $(H_{\mathrm{P}4}\le z\le H_{\mathrm{P}})$;

$W_P=W_{\mathrm{P}1}+W_{\mathrm{P}2}+W_{\mathrm{P}3}$, $W_{\mathrm{P}1}=0.5\gamma H_{\mathrm{P}1}^2\cot\eta$, $W_{\mathrm{P}2}=\gamma H_{\mathrm{P}2}H_{\mathrm{P}3}\cot\theta$, $W_{\mathrm{P}3}=0.5\gamma H_{\mathrm{P}3}^2\cot\theta$;

$Q_{\mathrm{hP}}=k_{\mathrm{h}}W_P$; $Q_{\mathrm{hP}}(t)=Q_{\mathrm{hP}1}+Q_{\mathrm{hP}2}+Q_{\mathrm{hP}3}$,

$Q_{\mathrm{hP}1}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}\cot\eta)(-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}1}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})\cot\eta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}1}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{P}1}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hP}2}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P}3}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}4})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})(H_{\mathrm{P}3}\cot\theta)/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}4}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}4})/TV_{\mathrm{s}})-H_{\mathrm{P}1}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}4})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P}1})/TV_{\mathrm{s}})]\}$,

$Q_{\mathrm{hP3}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P}}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T)-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})(H_{\mathrm{P}}\cot\theta)/H_{\mathrm{P}}-f_{\mathrm{a}}\cot\theta](-TV_{s}/2\pi)\{H_{\mathrm{P}}\cos2\pi(t/T)-H_{\mathrm{P4}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T)-\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)\cot\theta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}}^2\cos2\pi(t/T)-H_{\mathrm{P4}}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{P}}\sin2\pi(t/T)-H_{\mathrm{P4}}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T)-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}}))]\}$.

Case 4: $H\cot\beta>H_T(\cot\xi+\cot\eta)$

$H_{\mathrm{A1}}=[H\cot\beta-B_{\mathrm{T}}-H_{\mathrm{T}}(\cot\eta+\cot\xi)]\tan\eta$, $H_{\mathrm{A2}}=H_{\mathrm{T}}+H_{\mathrm{A1}}$, $H_{\mathrm{A3}}=H_{\mathrm{T}}+H$,

$H_{\mathrm{P4}}=H-H_{\mathrm{A1}}$,

$H_{\mathrm{B1}}=H_B\cot\alpha\tan\eta$, $H_{\mathrm{B2}}=H_B(1+\cot\alpha\tan\eta)$, $H_{\mathrm{P3}}=\left(H_{\mathrm{P4}}-H_{\mathrm{B2}}\right)/(\cot\theta\tan\eta-1)$,

$H_{\mathrm{A}}=H_{\mathrm{A3}}+H_{\mathrm{P3}}$, $H_{\mathrm{P2}}=H_{\mathrm{B2}}-H_{\mathrm{P3}}$, $H_{\mathrm{P1}}=H_{\mathrm{P4}}-H_{\mathrm{P2}}$, $H_{\mathrm{P}}=H_{\mathrm{P4}}+H_{\mathrm{P3}}$;

$C_P=c_PH_{\mathrm{P3}}/\sin\theta$, $C_{\mathrm{AP}}=cH_{\mathrm{P4}}$, $C_{\mathrm{PB}}=cH_{\mathrm{B2}}$;

$m_{\mathrm{A1}}(z)=\rho[B_{\mathrm{T}}+z(\cot\eta+\cot\xi)]$ $(0\le z<H_T)$,

$m_{\mathrm{A2}}(z)=\rho[B_{\mathrm{T}}+H_{\mathrm{T}}(\cot\beta+\cot\xi)+z(\cot\eta-\cot\beta)]$ $(H_{\mathrm{T}}\le z<H_{\mathrm{A2}})$,

$m_{\mathrm{A3}}(z)=\rho\left(H_{\mathrm{A3}}-z\right)\cot\beta$ $(H_{\mathrm{A2}}\le z\le H_{\mathrm{A3}})$;

$W_A=W_{\mathrm{A1}}+W_{\mathrm{A2}}+W_{\mathrm{A3}}$, $W_{\mathrm{A1}}=\gamma[B_{\mathrm{T}}H_{\mathrm{T}}+0.5H_{\mathrm{T}}^2(\cot\eta+\cot\xi)]$,

$W_{\mathrm{A2}}=\gamma\{H_{\mathrm{A1}}[B_{\mathrm{T}}+H_{\mathrm{T}}(\cot\beta+\cot\xi)]+0.5H_{\mathrm{A1}}\left(H_{\mathrm{T}}+H_{\mathrm{A2}}\right)(\cot\eta-\cot\beta)\}$,

$W_{\mathrm{A3}}=0.5\gamma\left(H_{\mathrm{A3}}-H_{\mathrm{A2}}\right)^2\cot\beta$; $Q_{\mathrm{hA}}=k_{\mathrm{h}}W_A$; $Q_{\mathrm{hA}}(t)=Q_{\mathrm{hA1}}+Q_{\mathrm{hA2}}+Q_{\mathrm{hA3}}$,

$Q_{\mathrm{hA1}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}B_{\mathrm{T}})(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}})]+[f_{\mathrm{a}}(\cot\eta+\cot\xi)+(1-f_{\mathrm{a}})B_{\mathrm{T}}/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{T}}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})(\cot\eta+\cot\xi)/H_{\mathrm{A}}](-TV_{s}/2\pi)\{H_{\mathrm{T}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{T}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{A}}/TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hA2}}/k_{\mathrm{h}}\gamma=f_{\mathrm{a}}[B_T+H_{\mathrm{T}}(\cot\beta+\cot\xi)](-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})]+\{f_{\mathrm{a}}(\cot\eta-\cot\beta)+(1-f_{\mathrm{a}})[B_{\mathrm{T}}+H_{\mathrm{T}}(\cot\beta+\cot\xi)]/H_{\mathrm{A}}\}(-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A2}}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-H_{\mathrm{T}}\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{A}}-H_T)/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})(\cot\eta-\cot\beta)/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A2}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-H_T^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{A2}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-H_T\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{T}})/TV_{\mathrm{s}}))]\}$,

$$Q_{\mathrm{hA3}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{A3}}\cot\beta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A3}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})]$$
$$+[(1-f_{\mathrm{a}})H_{\mathrm{A3}}\cot\beta/H_{\mathrm{A}}-f_{\mathrm{a}}\cot\beta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A3}}\cos2\pi\left(t/T-\left(H_{\mathrm{A}}-H_{\mathrm{A3}}\right)/TV_{\mathrm{s}}\right)-H_{\mathrm{A2}}\cos2\pi(t/T-(H_{\mathrm{A}}$$
$$-H_{\mathrm{A2}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A3}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)\cot\beta$$
$$/H_{\mathrm{A}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{A3}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A3}})/TV_{\mathrm{s}})-H_{\mathrm{A2}}^2\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{A3}}$$
$$\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A3}})/TV_{\mathrm{s}})-H_{\mathrm{T}}\sin2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A3}})$$
$$/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{A}}-H_{\mathrm{A2}})/TV_{\mathrm{s}}))]\}.$$

$$m_{\mathrm{P1}}(z)=\rho z\cot\eta\quad(0\le z<H_{\mathrm{P1}}),\quad m_{\mathrm{P2}}=\rho H_{\mathrm{P3}}\cot\theta\quad(H_{\mathrm{P1}}\le z<H_{\mathrm{P4}}),$$

$$m_{\mathrm{P3}}(\mathrm{z})=\rho\left(H_{\mathrm{P}}-z\right)\cot\theta\quad(H_{\mathrm{P4}}\le z\le H_{\mathrm{P}});$$

$$W_P=W_{\mathrm{P1}}+W_{\mathrm{P2}}+W_{\mathrm{P3}},\quad W_{\mathrm{P1}}=0.5\gamma H_{\mathrm{P1}}^2\cot\eta,\quad W_{\mathrm{P2}}=\gamma H_{\mathrm{P2}}H_{\mathrm{P3}}\cot\theta,\quad W_{\mathrm{P3}}=0.5\gamma H_{\mathrm{P3}}^2\cot\theta;$$

$$Q_{\mathrm{hP}}=k_{\mathrm{h}}W_P;\quad Q_{\mathrm{hP}}\left(t\right)=Q_{\mathrm{hP1}}+Q_{\mathrm{hP2}}+Q_{\mathrm{hP3}},$$

$$Q_{\mathrm{hP1}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}\cot\eta)(-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P1}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/$$
$$TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})\cot\eta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P1}}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/$$
$$\pi)[H_{\mathrm{P1}}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-H_{\mathrm{P}}/TV_{\mathrm{s}}))]\},$$

$$Q_{\mathrm{hP2}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P3}}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/$$
$$TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})(H_{\mathrm{P3}}\cot\theta)/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P4}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-H_{\mathrm{P1}}\cos2\pi(t/T$$
$$-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P1}})/TV_{\mathrm{s}})]\},$$

$$Q_{\mathrm{hP3}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}H_{\mathrm{P}}\cot\theta)(-TV_{\mathrm{s}}/2\pi)[\cos2\pi(t/T)-\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]+[(1-f_{\mathrm{a}})(H_{\mathrm{P}}\cot\theta)/H_{\mathrm{P}}$$
$$-f_{\mathrm{a}}\cot\theta](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}}\cos2\pi(t/T)-H_{\mathrm{P4}}\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T)-\sin2\pi$$
$$(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})]\}+[(f_{\mathrm{a}}-1)\cot\theta/H_{\mathrm{P}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{P}}^2\cos2\pi(t/T)-H_{\mathrm{P4}}^2\cos2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/$$
$$TV_{\mathrm{s}})-(TV_{\mathrm{s}}/\pi)[H_{\mathrm{P}}\sin2\pi(t/T)-H_{\mathrm{P4}}\sin2\pi(t/T-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T)-\cos2\pi(t/T$$
$$-(H_{\mathrm{P}}-H_{\mathrm{P4}})/TV_{\mathrm{s}}))]\}.$$

The four cases having the same C_{A}, C_B, Q_{hB}, and $Q_{\mathrm{hB}}(t)$, as follows:

$$C_{\mathrm{A}}=c_{\mathrm{A}}H/\sin\beta,\quad C_B=c_B[D_B+H_B(\cot\zeta+\cot\alpha)];$$

$$m_{\mathrm{B1}}(z)=\rho z\cot\eta\,(0\le z<H_{\mathrm{B1}}),\quad m_{\mathrm{B2}}(z)=\rho(H_{\mathrm{B2}}-z)\cot\alpha\,(H_{\mathrm{B1}}\le z\le H_{\mathrm{B2}}),$$

$$m_{\mathrm{B3}}(z)=\rho_{\mathrm{B}}[D_B+z(\cot\zeta+\cot\alpha)]\,(0\le z\le H_B);$$

$$W_B=W_{\mathrm{B1}}+W_{\mathrm{B2}}+W_{\mathrm{B3}},\quad W_{\mathrm{B1}}=0.5\gamma H_{\mathrm{B1}}^2\cot\eta,\quad W_{\mathrm{B2}}=0.5\gamma H_{\mathrm{B}}^2\cot\alpha,$$

$$W_{\mathrm{B3}}=\gamma_{\mathrm{B}}[H_{\mathrm{B}}D_{\mathrm{B}}+0.5H_{\mathrm{B}}^2(\cot\zeta+\cot\alpha)];\quad Q_{\mathrm{hB}}=k_{\mathrm{h}}W_B;\quad Q_{\mathrm{hB}}\left(t\right)=Q_{\mathrm{hB1}}+Q_{\mathrm{hB2}}+Q_{\mathrm{hB3}},$$

$$Q_{\mathrm{hB1}}/k_{\mathrm{h}}\gamma=(f_{\mathrm{a}}\cot\eta)(-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{B1}}\cos2\pi(t/T-(H_{\mathrm{B2}}-H_{\mathrm{B1}})/TV_{\mathrm{s}})-(TV_{\mathrm{s}}/2\pi)[\sin2\pi(t/T-(H_{\mathrm{B2}}-H_{\mathrm{B1}})$$
$$/TV_{\mathrm{s}})-\sin2\pi(t/T-H_{\mathrm{B2}}/TV_{\mathrm{s}})]\}+[(1-f_{\mathrm{a}})\cot\eta/H_{\mathrm{B2}}](-TV_{\mathrm{s}}/2\pi)\{H_{\mathrm{B1}}^2\cos2\pi(t/T-(H_{\mathrm{B2}}-H_{\mathrm{B1}})/TV_{\mathrm{s}})-$$
$$(TV_{\mathrm{s}}/\pi)[H_{\mathrm{B1}}\sin2\pi(t/T-(H_{\mathrm{B2}}-H_{\mathrm{B1}})/TV_{\mathrm{s}})+(TV_{\mathrm{s}}/2\pi)(\cos2\pi(t/T-(H_{\mathrm{B2}}-H_{\mathrm{B1}})/TV_{\mathrm{s}})-\cos2\pi(t/T-$$
$$H_{\mathrm{B2}}/TV_{\mathrm{s}}))]\},$$

$Q_{\mathrm{hB2}} / k_{\mathrm{h}}\gamma = (f_{\mathrm{a}} H_{\mathrm{B2}}\cot\alpha)(-TV_{\mathrm{s}} / 2\pi)[\cos 2\pi(t / T) - \cos 2\pi(t / T - (H_{\mathrm{B2}} - H_{\mathrm{Bl}}) / TV_{\mathrm{s}})] + [(1 - 2f_{\mathrm{a}})\cot\alpha]$ $(-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{B2}}\cos 2\pi(t / T) - H_{\mathrm{Bl}}\cos 2\pi(t / T - (H_{\mathrm{B2}} - H_{\mathrm{Bl}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / 2\pi)[\sin 2\pi(t / T) - \sin 2\pi(t$ $/T - (H_{\mathrm{B2}} - H_{\mathrm{Bl}}) / TV_{\mathrm{s}})]\} + [(f_{\mathrm{a}} - 1)\cot\alpha / H_{\mathrm{B2}}](-TV_{\mathrm{s}} / 2\pi)\{H_{\mathrm{B2}}^2\cos 2\pi(t / T) - H_{\mathrm{Bl}}^2\cos 2\pi(t / T - (H_{\mathrm{B2}} -$ $H_{\mathrm{Bl}}) / TV_{\mathrm{s}}) - (TV_{\mathrm{s}} / \pi)[H_{\mathrm{B2}}\sin 2\pi(t / T) - H_{\mathrm{Bl}}\sin 2\pi(t / T - (H_{\mathrm{B2}} - H_{\mathrm{Bl}}) / TV_{\mathrm{s}}) + (TV_{\mathrm{s}} / 2\pi)(\cos 2\pi(t / T)$ $-\cos 2\pi(t / T - (H_{\mathrm{B2}} - H_{\mathrm{Bl}}) / TV_{\mathrm{s}}))]\}$,

$Q_{\mathrm{hB3}} / k_{\mathrm{h}}\gamma_{\mathrm{B}} = (f_{\mathrm{a}} D_B)(-TV_{\mathrm{sB}} / 2\pi)[\cos 2\pi(t / T) - \cos 2\pi(t / T - H_B / TV_{\mathrm{sB}})] + [f_{\mathrm{a}}(\cot\zeta + \cot\alpha) + (1 - f_{\mathrm{a}})D_B$ $/H_B](-TV_{\mathrm{sB}} / 2\pi)\{H_{\mathrm{B}}\cos 2\pi(t / T) - (TV_{\mathrm{sB}} / 2\pi)[\sin 2\pi(t / T) - \sin 2\pi(t / T - H_{\mathrm{B}} / TV_{\mathrm{sB}})]\} + [(1 - f_{\mathrm{a}})(\cot\zeta +$ $\cot\alpha) / H_{\mathrm{B}}](-TV_{\mathrm{sB}} / 2\pi)\{H_{\mathrm{B}}^2\cos 2\pi(t / T) - (TV_{\mathrm{sB}} / \pi)[H_{\mathrm{B}}\sin 2\pi(t / T) + (TV_{\mathrm{sB}} / 2\pi)(\cos 2\pi(t / T) - \cos 2\pi(t$ $/T - H_{\mathrm{B}} / TV_{\mathrm{sB}}))]\}$.

Q_{vA}, Q_{vB}, and Q_{vP}, for the four cases, as follows:

k_{v} substitutes k_{h} in Q_{hA}, Q_{hB}, and Q_{hP}, that turn into Q_{vA}, Q_{vB}, and Q_{vP}, respectively.

$Q_{\mathrm{vA}}(t)$, $Q_{\mathrm{vB}}(t)$, and $Q_{\mathrm{vP}}(t)$, for the four cases, as follows:

k_{v} substitutes k_{h} in $Q_{\mathrm{hA}}(t)$, $Q_{\mathrm{hB}}(t)$, and $Q_{\mathrm{hP}}(t)$, that turn into $Q_{\mathrm{vA}}(t)$, $Q_{\mathrm{vB}}(t)$, and $Q_{\mathrm{vP}}(t)$, respectively.

File S2 $\mathrm{FS}_{\mathrm{min}}$ and $\mathrm{FS}_{\mathrm{max}}$

$\mathrm{FS}_{\mathrm{min}}$ can be obtained by the following equation:

$(\cos\theta + \sin\theta\tan\delta_{\mathrm{P}} / \mathrm{FS})\{[(W_B + Q_{\mathrm{vB}}(t))\tan\delta_B / \mathrm{FS} - Q_{\mathrm{hB}}(t) + C_{\mathrm{B}} / \mathrm{FS}] - [(W_A + Q_{\mathrm{vA}}(t))(\sin\beta - \cos\beta\tan\delta_{\mathrm{A}}$ $/\mathrm{FS}) - C_{\mathrm{A}} / FS + Q_{hA}(t)(\cos\beta + \sin\beta\tan\delta_{\mathrm{A}} / \mathrm{FS})] / (\cos\beta + \sin\beta\tan\delta_{\mathrm{A}} / \mathrm{FS})\} = (W_{\mathrm{P}} + Q_{\mathrm{vP}}(t))(\sin\theta - \cos\theta$ $\tan\delta_{\mathrm{P}} / \mathrm{FS}) - C_{\mathrm{P}} / FS + Q_{\mathrm{hP}}(t)(\cos\theta + \sin\theta\tan\delta_{\mathrm{P}} / \mathrm{FS})$.

$\mathrm{FS}_{\mathrm{max}}$ can be obtained by the following equation:

$[(\cos\theta + \sin\theta\tan\delta_{\mathrm{P}} / \mathrm{FS}) + (\sin\theta - \cos\theta\tan\delta_{\mathrm{P}} / \mathrm{FS})\tan\phi / \mathrm{FS}]\{[(W_{\mathrm{B}} + Q_{\mathrm{vB}}(t) + \mathrm{C}_{\mathrm{PB}} / \mathrm{FS})\tan\delta_{\mathrm{B}} / \mathrm{FS} - Q_{\mathrm{hB}}(t)$ $+C_{\mathrm{B}} / \mathrm{FS}] / (1 - \tan\delta_{\mathrm{B}}\tan\phi / \mathrm{FS}^2) - [(W_{\mathrm{A}} + Q_{\mathrm{vA}}(t) - C_{\mathrm{AP}} / \mathrm{FS})(\sin\beta - \cos\beta\tan\delta_{\mathrm{A}} / \mathrm{FS}) - C_{\mathrm{A}} / \mathrm{FS} + Q_{\mathrm{hA}}(t)(\cos\beta$ $+\sin\beta\tan\delta_{\mathrm{A}} / \mathrm{FS})] / [(\cos\beta + \sin\beta\tan\delta_{\mathrm{A}} / \mathrm{FS}) + (\sin\beta - \cos\beta\tan\delta_{\mathrm{A}} / \mathrm{FS})\tan\phi / \mathrm{FS}]\} = (W_{\mathrm{P}} + Q_{\mathrm{vP}}(t) + C_{\mathrm{AP}} /$ $\mathrm{FS} - C_{\mathrm{PB}} / \mathrm{FS})(\sin\theta - \cos\theta\tan\delta_{\mathrm{P}} / \mathrm{FS}) - C_{\mathrm{P}} / \mathrm{FS} + Q_{\mathrm{hP}}(t)(\cos\theta + \sin\theta\tan\delta_{\mathrm{P}} / \mathrm{FS})$.