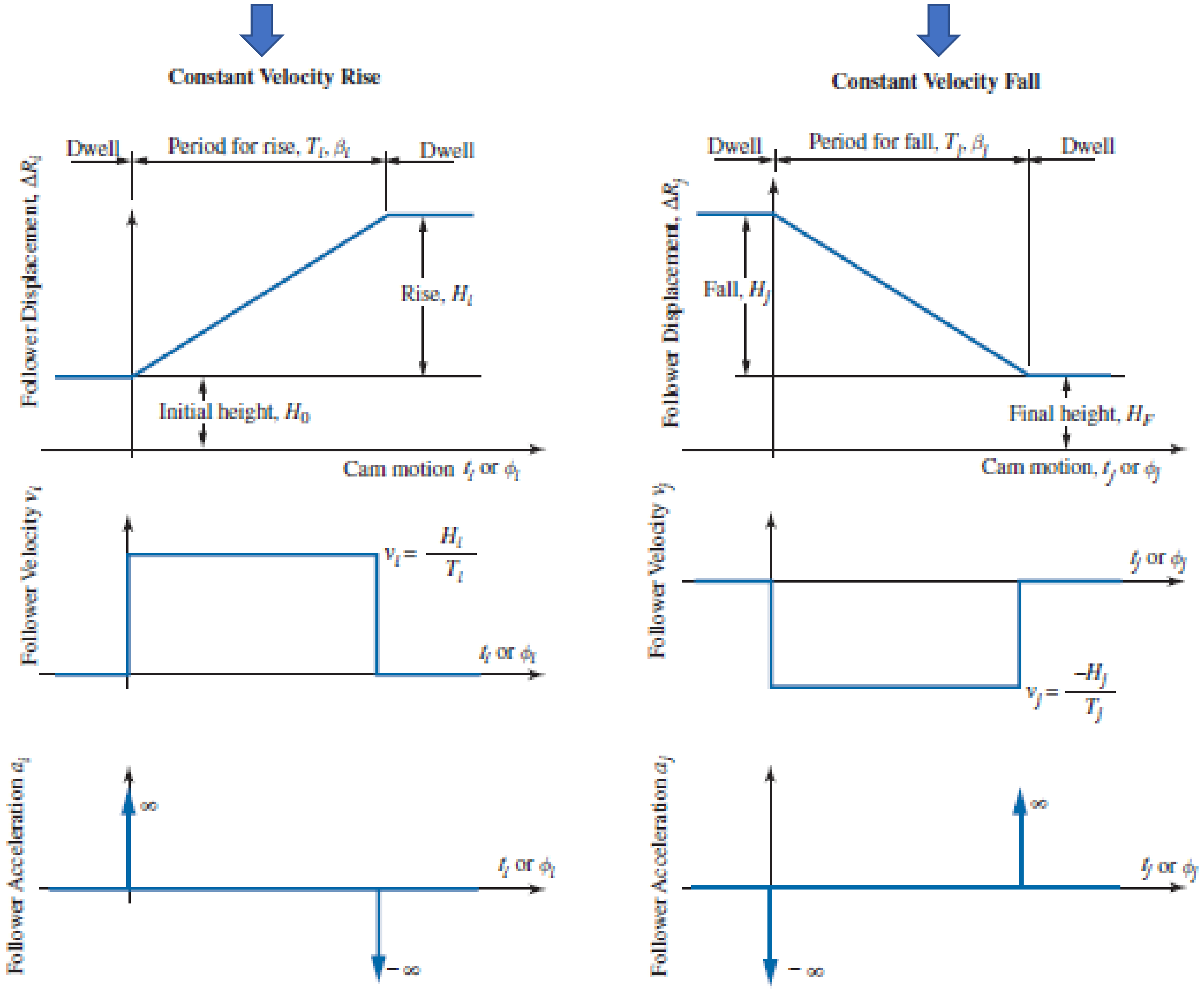
Cam-Follower Kinematics

TABLE 9.1 Cam Follower Kinematics for Constant Velocity Motion

	Rise	Fall
Displacement:	$\Delta R_i = H_0 + \dfrac{H_i t_i}{T_i} = H_0 + \dfrac{H_i \phi_i}{\beta_i}$	$\Delta R_j = H_F + H_j\left(1 - \dfrac{t_j}{T_j}\right) = H_F + H_j\left(1 - \dfrac{\phi_j}{\beta_j}\right)$
Velocity:	$v_i = \dfrac{H_i}{T_i} = \dfrac{H_i \omega}{\beta_i}$	$v_j = \dfrac{-H_j}{T_j} = \dfrac{-H_j \omega}{\beta_j}$
Acceleration:	$a = 0$ (∞ at transitions)	$a = 0$ (∞ at transitions)



Constant velocity motion curves.

TABLE 9.2 Cam Follower Kinematics for Constant Acceleration Motion

	Rise	Fall
For $0 < t < 0.5\,T$ $(0 < \phi < 0.5\,\beta)$:		
Displacement:	$\Delta R_i = H_0 + 2H_i\left(\frac{t_i}{T_i}\right)^2 = H_0 + 2H_i\left(\frac{\phi_i}{\beta_i}\right)^2$	$\Delta R_i = H_F + H_j - 2H_j\left(\frac{t_j}{T_j}\right)^2 = H_F + H_j - 2H_j\left(\frac{\phi_j}{\beta_j}\right)^2$
Velocity:	$v_i = \frac{4H_i t_i}{T_i^2} = \frac{4H_i \omega \phi_i}{\beta_i^2}$	$v_j = \frac{-4H_j t_j}{T_j^2} = \frac{-4H_j \omega \phi_j}{\beta_j^2}$
Acceleration:	$a_i = \frac{4H_i}{T_i^2} = \frac{4H_i \omega^2}{\beta_i^2}$	$a_j = \frac{-4H_j}{T_j^2} = \frac{-4H_j \omega^2}{\beta_j^2}$
For $0.5\,T < t < T$ $(0.5\,\beta < \phi < \beta)$:		
Displacement:	$\Delta R_i = H_0 + H_i - 2H_i\left(1 - \frac{t_i}{T_i}\right)^2 = H_0 + H_i + 2H_i\left(1 - \frac{\phi_i}{\beta_i}\right)^2$	$\Delta R_j = H_F + 2H_j\left(1 - \frac{t_j}{T_j}\right)^2 = H_F + 2H_j\left(1 - \frac{\phi_j}{\beta_j}\right)^2$
Velocity:	$v_i = \frac{4H_i}{T_i}\left(1 - \frac{t_i}{T_i}\right) = \frac{4H_i \omega}{\beta_i}\left(1 - \frac{\phi_i}{\beta_i}\right)$	$v_i = \frac{-4H_j}{T_j}\left(1 - \frac{t_j}{T_j}\right) = \frac{-4H_j \omega}{\beta_j}\left(1 - \frac{\phi_j}{\beta_j}\right)$
Acceleration:	$a_i = \frac{-4H_i}{T_i^2} = \frac{-4H_i \omega^2}{\beta_i^2}$	$a_j = \frac{4H_j}{T_j^2} = \frac{4H_j \omega^2}{\beta_j^2}$

Source: Myszka, D.H. Machines and Mech. Applied Kinematic Analysis. Prentice Hall. 4th Edition. USA.

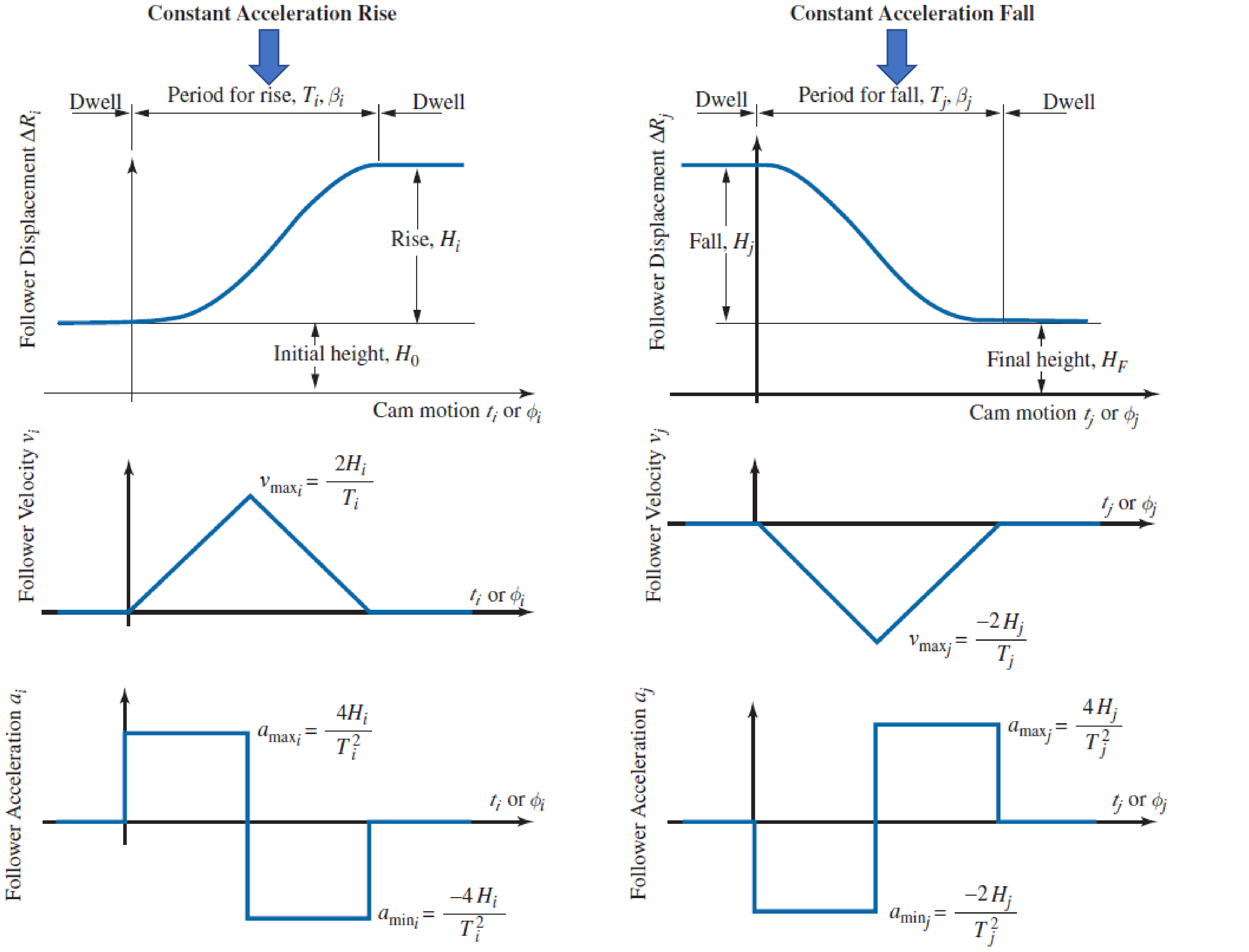


Figure (c) Constant Acceleration Motion Curves.

TABLE 9.3 Cam Follower Kinematics for Harmonic Motion

	Rise	Fall
Displacement:	$\Delta R_i = H_0 + \frac{H_i}{2}\left[1 - \cos\left(\frac{\pi t_i}{T_i}\right)\right]$ $= H_0 + \frac{H_i}{2}\left[1 - \cos\left(\frac{\pi \phi_i}{\beta_i}\right)\right]$	$\Delta R_j = H_F + \frac{H_j}{2}\left[1 + \cos\left(\frac{\pi t_j}{T_j}\right)\right]$ $= H_F + \frac{H_j}{2}\left[1 - \cos\left(\frac{\pi \phi_j}{\beta_j}\right)\right]$
Velocity:	$v_i = \frac{\pi H_i}{2T_i}\left[\sin\left(\frac{\pi t_i}{T_i}\right)\right]$ $= \frac{\pi H_i \omega}{2\beta_i}\left[\sin\left(\frac{\pi \phi_i}{\beta_i}\right)\right]$	$v_j = \frac{-\pi H_j}{2T_j}\left[\sin\left(\frac{\pi t_j}{T_j}\right)\right]$ $= \frac{-\pi H_j \omega}{2\beta_j}\left[\sin\left(\frac{\pi \phi_j}{\beta_j}\right)\right]$
Acceleration:	$a_i = \frac{\pi^2 H_i}{2T_i^2}\left[\cos\left(\frac{\pi t_i}{T_i}\right)\right]$ $= \frac{\pi^2 H_i \omega^2}{2\beta_i^2}\left[\cos\left(\frac{\pi \phi_i}{\beta_i}\right)\right]$	$a_j = \frac{-\pi^2 H_i}{2T_i^2}\left[\cos\left(\frac{\pi t_j}{T_j}\right)\right]$ $= \frac{-\pi^2 H_j \omega^2}{2\beta_j^2}\left[\cos\left(\frac{\pi \phi_j}{\beta_j}\right)\right]$

Source: Myszka, D.H. Machines and Mech. Applied Kinematic Analysis. Prentice Hall. 4th Edition. USA.

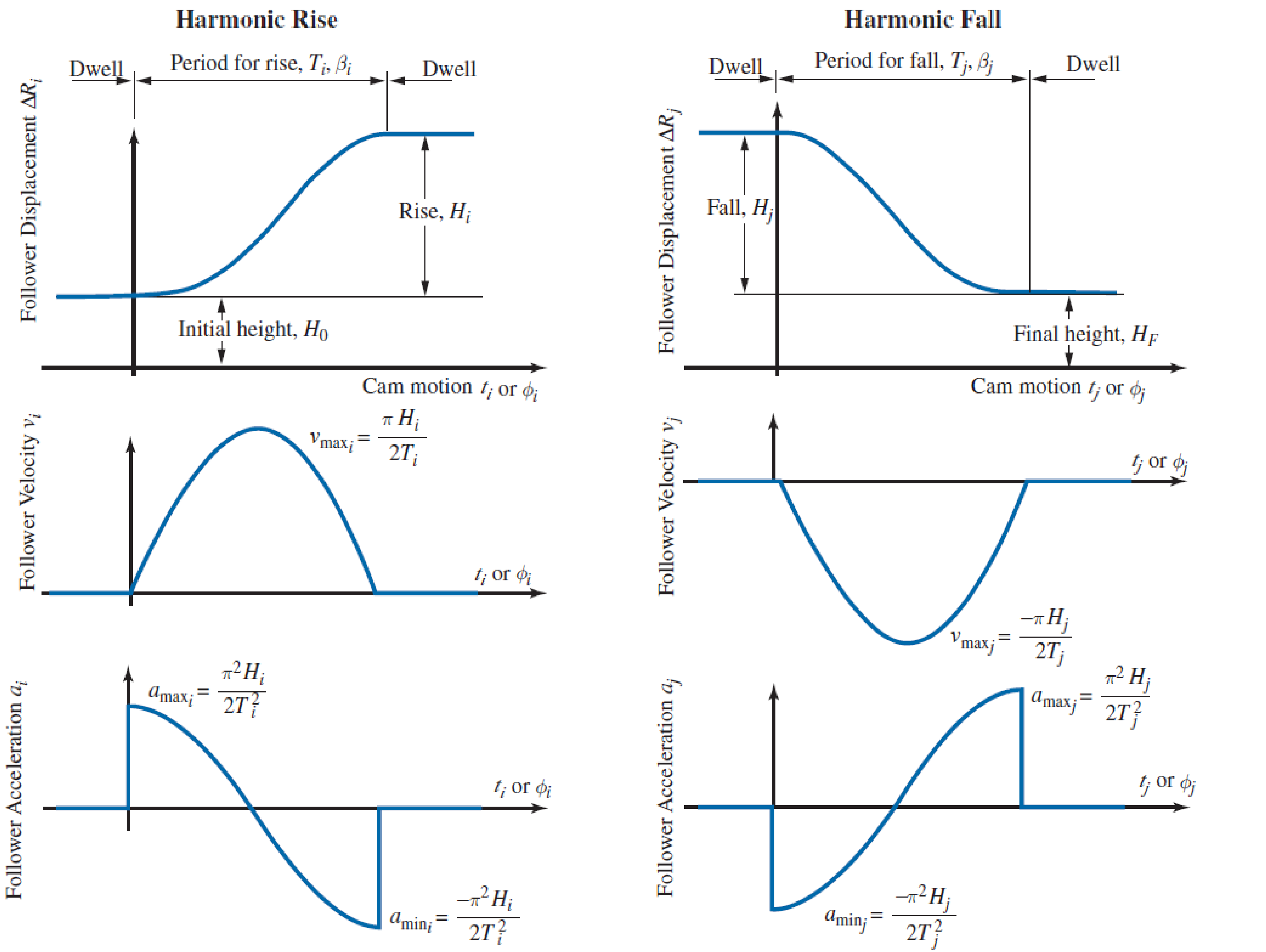


Figure (d) Harmonic Motion Curves.

Source: Myszka, D.H. Machines and Mech. Applied Kinematic Analysis. Prentice Hall. 4th Edition. USA.

TABLE 9.4 Cam Follower Kinematics for Cycloidal Motion

	Rise	Fall
Displacement:	$\Delta R_i = H_0 + H_i\left[\frac{t_i}{T_i} - \frac{1}{2\pi}\sin\left(\frac{2\pi t_i}{T_i}\right)\right]$ $= H_0 + H_i\left[\frac{\phi_i}{\beta_i} - \frac{1}{2\pi}\sin\left(\frac{2\pi \phi_i}{\beta_i}\right)\right]$	$\Delta R_j = H_F + H_j\left[1 - \frac{t_j}{T_j} + \frac{1}{2\pi}\sin\left(\frac{2\pi t_j}{T_j}\right)\right]$ $= H_F + H_j\left[\frac{\phi_j}{\beta_j} - \frac{1}{2\pi}\sin\left(\frac{2\pi \phi_j}{\beta_j}\right)\right]$
Velocity:	$v_i = \frac{H_i}{T_i}\left[1 - \cos\left(\frac{2\pi t_i}{T_i}\right)\right]$ $= \frac{H_i\omega}{\beta_i}\left[1 - \cos\left(\frac{2\pi \phi_i}{\beta_i}\right)\right]$	$v_j = \frac{-H_j}{T_i}\left[1 - \cos\left(\frac{2\pi t_i}{T_i}\right)\right]$ $= \frac{-H_j\omega}{\beta_j}\left[1 - \cos\left(\frac{2\pi \phi_j}{\beta_j}\right)\right]$
Acceleration:	$a_i = \frac{2\pi H_i}{T_i^2}\left[\sin\left(\frac{2\pi t_i}{T_i}\right)\right]$ $= \frac{2\pi H_i\omega^2}{\beta_i^2}\left[\sin\left(\frac{2\pi \phi_i}{\beta_i}\right)\right]$	$a_j = \frac{-2\pi H_j}{T_j^2}\left[\sin\left(\frac{2\pi t_j}{T_j}\right)\right]$ $= \frac{-2\pi H_j\omega^2}{\beta_j^2}\left[\sin\left(\frac{2\pi \phi_j}{\beta_j}\right)\right]$

Source: Myszka, D.H. Machines and Mech. Applied Kinematic Analysis. Prentice Hall. 4th Edition. USA.

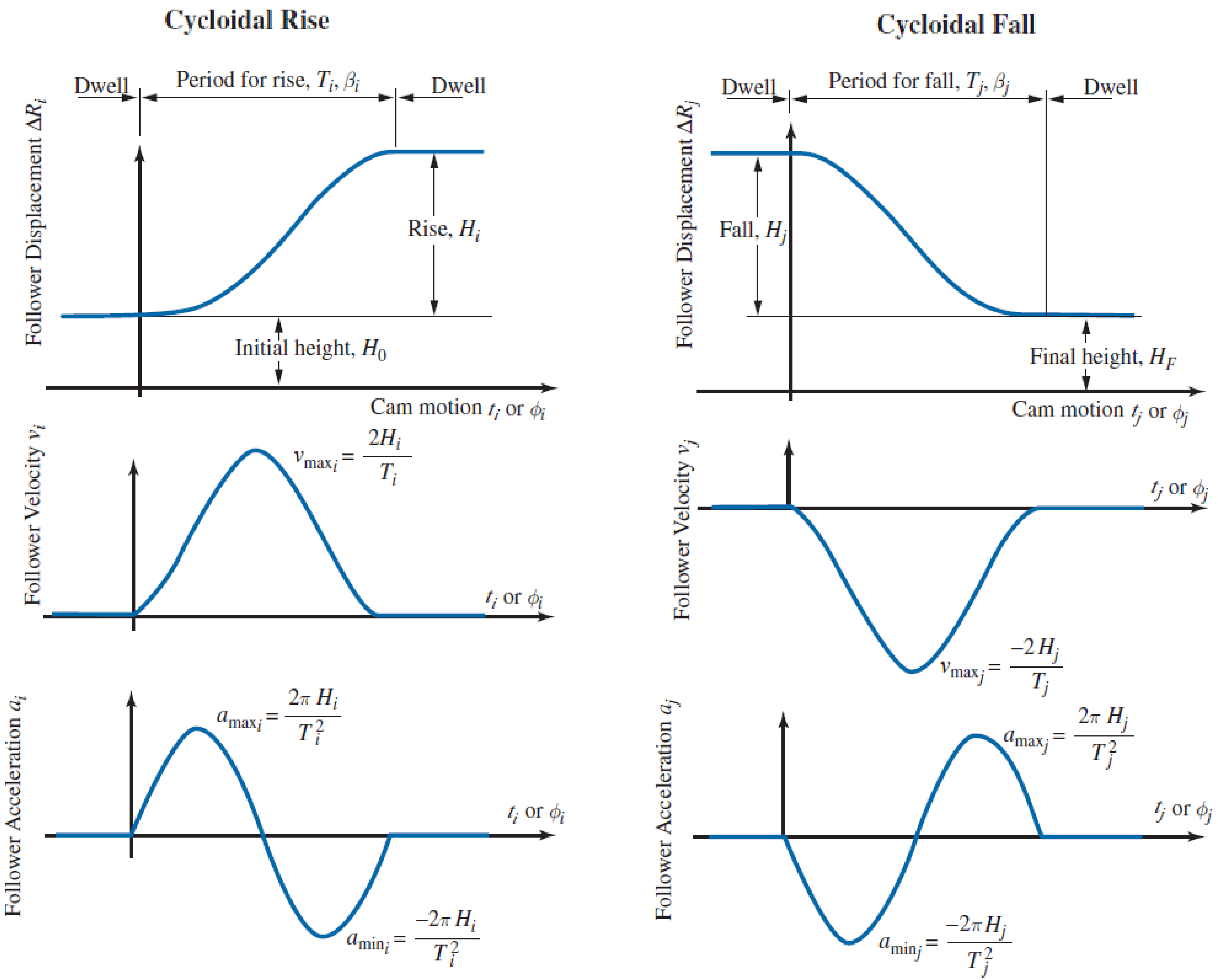


Figure (e) Cycloidal Motion Curves.

Source: Myszka, D.H. Machines and Mech. Applied Kinematic Analysis. Prentice Hall. 4th Edition. USA.