The *convective velocity* is the velocity of the onset flow, whose speed we denote U. If c is a characteristic length (typically the airfoil chord), the *convective time* τ is the time required for the onset flow to travel a distance equal to the characteristic length c, i.e.

$$\tau = c/U.$$

If the airfoil is oscillating with *fundamental frequency* f (Hz) (and hence with period $T = 1/f$), we define the *reduced frequency* k as the number of oscillations in a duration of one convective time, i.e.

$$k = f\tau.$$

Note that if $T = 1/f$ is the period of oscillation, then $k = \tau/T = fc/U$. The definition $k = f\tau$ is a natural one, but other conventions are in use. In particular, some authors define a reduced frequency k' by

$$k' = \frac{\omega c}{2U} = \pi k,$$

where $\omega = 2\pi f$ is the angular frequency (rad/sec) of oscillation.

If the motion (e.g. of the airfoil's trailing edge) has amplitude a, the *Strouhal number* is

$$St = \frac{f\,a}{U}.$$

We have the following relationships between the definitions:

$$\boxed{\frac{\tau}{T} = f\tau = 2\pi\omega\tau = k = \frac{k'}{\pi} = \frac{f\,c}{U} = St \cdot \frac{c}{a}}$$

For multi-frequency motions, we have found it useful to introduce the *generalized Strouhal number*

$$St_* := \frac{\frac{1}{T}\int_0^T |\dot{y}|}{U}\,dt,$$

where T is the period of the fundamental mode, and $\dot{y}$ is the heave velocity.