## The oscillating vortex

The flow we consider is the time-dependent two-dimensional defined by velocity field defined by

$$
u(x, y, t), v(x, y, t)=y / R^{2},-(x-\epsilon \cos (\omega t)) / R^{2}, R^{2}=(x-\epsilon \cos (\omega t))^{2}+y^{2}
$$

where $\epsilon, \omega$ are constants. The instantaneous streamlines of this flow are concentric circles with center at $(\epsilon \cos (\omega t), 0)$.

Path lines may be obtained by solving $d x / d t=u, d y / d t-v, X(0)=a, y(0)=b$, yielding the Lagrangian coordinates $x(a, b, t), y(a, b, t)$.

Streak lines are computed by solving from $t_{0}<t$ up to a fixed $t$ for various $t_{0}$, with $x\left(t_{0}=a, y\left(t_{0}\right)=b\right.$.

