$$
\begin{aligned}
\mathbf{B}_{tube} &= \nabla \times \left[\frac{A(r,\theta)}{r\sin\theta} \hat{\phi} \right] + B_\phi(r,\theta)\hat{\phi} \\
A(r,\theta) &= \frac{1}{2} q\, a^2\, B_t\, \exp\left[-\frac{\varpi(r,\theta)}{a^2} \right] \\
B_\phi &= \frac{a\, B_t}{r\sin\theta} \exp\left[-\frac{\varpi(r,\theta)}{a^2} \right]
\end{aligned}
$$

where r is the radial distance from the origin; $r_0(t)$, θ is the polar angle from the polar axis, $\hat{\phi}$ is the azimuthal direction, $\varpi = (r^2 + R^2 - 2rR\sin^2\theta)^{1/2}$ is the distance to the tube axis. Morever, we have

$$
\begin{aligned}
B_t &= 9\, B_0 \\
B_0 &= 1.0 \\
q &= -1 \\
a &= 0,1\, L \\
L &= 0.0 \\
R &= 0.375
\end{aligned}
$$

The Cartesian domain has the following sizes:

$$
\begin{array}{llll}
n_X = & 30 & L_X & = [0, 1.5] \\
n_Y = & 20 & L_Y & = [0, 1.0] \\
n_Z = & 25 & L_Z & = [0, 1.25]
\end{array}
$$

We have set the following boundary conditions:

BC$_X$**:** rigid walls;

BC$_Y$**:** periodic;

BC$_Z$**:** rigid walls;