$$\frac{\partial u_z}{\partial t} = v\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial u_z}{\partial r}\right) - \frac{1}{\rho}\frac{\partial p}{\partial z}$$

where v is the kinematic viscosity and ρ is the density of the fluid. The position along the radius of the blood vessel is measured by r. The pressure gradient oscillates in time with frequency, $\omega(\mathrm{rad/s})$, to simulate the pumping action of the heart:

$$-\frac{\partial p}{\partial z} = \frac{\Delta p}{L}\cos(\omega t)$$

The initial and boundary conditions for this problem are as follows:
Initial condition:

$$t = 0 \; u_z = u_{z0}$$

Boundary conditions: $t > 0 \; r = 0 \; \frac{\partial u_z}{\partial r} = 0 \; u_z$ is finite

$$r = R \; u_z = 0$$

The following constants may be used for the solution of this problem. These are characteristic of the human left main artery, human blood, and heart pumping action:

$$R = 0.425 \text{ cm } V = 0.09 \text{ cm}^2/\text{s } \rho = 1 \text{ g/cm}^3$$
$$\omega = 3 \text{ cycles per second } = 6\pi \text{rad/s}$$
$$\frac{\Delta p}{L} = 1 \text{ dyne }/\text{cm}^3 = 1(\text{ g.cm }/\text{s}^2)/\text{cm}^3$$