GIUSY MAZZONE, Queen's University

Periodic motion of a harmonic oscillator interacting with a viscous fluid

We consider the motion of a harmonic oscillator immersed in a viscous incompressible fluid within an infinite pipe. The motion of the fluid is driven by a prescribed, time-periodic flow rate. As the fluid flows in the channel, it may exert a periodic force on the oscillator. In this setting, if the frequency of this force matches the natural frequency of the oscillator, then the phenomenon of resonance may occur with the mass oscillating with increasing amplitude. Because of the phenomenon of resonance, the motion of the harmonic oscillator would not be time-periodic. We will show that resonance does not occur in the class of weak solutions to the governing equations if the flow rate is "sufficiently small". In addition, we will prove that -at a large distance from the oscillator- the fluid velocity converges to the time-periodic generalization of the Poiseuille flow in an infinite pipe.