Accretion Homework 6

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December 6, 2019

1 Constant Viscousity

$$\frac{\partial \Sigma}{\partial t} = \frac{3\nu}{r} \frac{\partial [\sqrt{r} \frac{\partial(\sqrt{r}\Sigma)}{\partial r}]}{\partial r} \tag{1}$$

We define $\nu = \nu_0,\ \widetilde{\Sigma} = \Sigma\sqrt{r}$ and $x = \sqrt{r}$, then we have:

$$x^2 \frac{\partial \widetilde{\Sigma}}{\partial t} = \frac{3\nu_0}{4} \frac{\partial^2 \widetilde{\Sigma}}{\partial x^2} \tag{2}$$

I use a gaussian initial condition and a Neumman boundary condition to plot Figure.1

2 Variable Viscousity

$$\frac{\partial \Sigma}{\partial t} = \frac{3\nu}{r} \frac{\partial [\sqrt{r} \frac{\partial(\sqrt{r}\Sigma)}{\partial r}]}{\partial r} \tag{3}$$

We define $\nu = \nu_0 * r,\ \widetilde{\Sigma} = \Sigma r^{3/2}$ and $x = \sqrt{r}$, then we have:

$$\frac{\partial \widetilde{\Sigma}}{\partial t} = \frac{3\nu_0}{4} \frac{\partial^2 \widetilde{\Sigma}}{\partial x^2} \tag{4}$$

I use a gaussian initial condition and a Neumman boundary condition to plot Figure.2

We can find that mass accretion in Figure.2 is more obvious than that in Figure.2 while the diffusion is roughly the same.

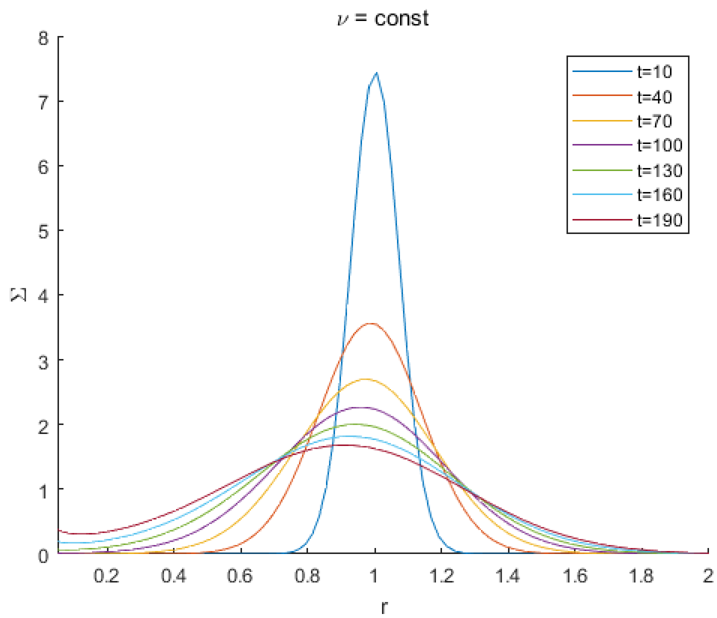

Figure 1: solution with constant viscousity.

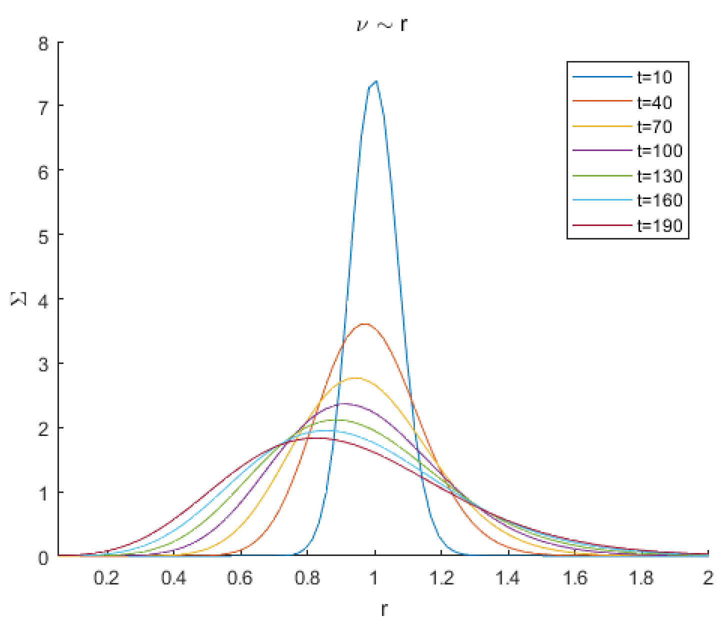

Figure 2: solution with variable viscousity.