with pressure(t)

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1 Introduction

$$\eta v = -k\left(l^* + \delta - v_p t\right) - f(t)(\sigma - P(t)) \tag{1}$$

On dérive par rapport au temps :

$$\eta \frac{dv}{dt} = -k(v - v_p) - \left(\frac{df}{dt}(\sigma - P(t)) - \frac{dP}{dt} f(t)\right) \tag{2}$$

On multiplie par $\frac{d_c}{v_p b \sigma}$ (idem que le cas sans pression de fluide) :

$$\left(\bar{\eta} + \frac{\alpha}{\bar{v}}(1 - \frac{P(t)}{\sigma})\right) \frac{d\bar{v}}{d\bar{t}} = -\kappa(\bar{v}-1) + (\bar{v} - \frac{1}{\bar{\theta}})(1 - \frac{P(t)}{\sigma}) - \left(f_0 + a\ln(\bar{v}) + b\ln(\bar{\theta})\right) \frac{d_c}{v_p b \sigma} \frac{dP}{dt} \tag{3}$$

Or, on a:

$$\frac{P(t)}{\sigma} = \bar{P_\infty} erfc(\frac{\bar{r}}{2\sqrt{\bar{c}\bar{t}}}) \tag{4}$$

$$\frac{d_c}{v_p b \sigma} \frac{dP}{dt} = \frac{1}{b} \frac{1}{2\sqrt{\pi}} \frac{\bar{P_\infty}}{\bar{t}} e^{-\left(\frac{\bar{r}}{2\sqrt{\bar{c}\bar{t}}}\right)^2} \tag{5}$$

Les variables adimensionnées étant:

$$\bar{r} = \frac{r}{L^\star} = \frac{r}{\frac{\mu d_c}{b\sigma}}, \qquad \bar{c} = c\frac{b^2\sigma^2}{v_p \mu^2 d_c}, \qquad \bar{P_\infty} = \frac{P_\infty}{\sigma}$$

$$\boxed{\frac{-\kappa(\bar{v}-1) + (\bar{v} - \frac{1}{\bar{\theta}})(1 - \bar{P_\infty} erfc(\frac{\bar{r}}{2\sqrt{\bar{c}\bar{t}}})) - \left(f_0 + a\ln(\bar{v}) + b\ln(\bar{\theta})\right) \frac{\bar{P_\infty}}{\bar{t}} e^{-\left(\frac{\bar{r}}{2\sqrt{\bar{c}\bar{t}}}\right)^2}}{\bar{\eta}\bar{v} + \alpha(1 - \bar{P_\infty} erfc(\frac{\bar{r}}{2\sqrt{\bar{c}\bar{t}}}))} d\bar{t} = \frac{d\bar{v}}{\bar{v}}} \tag{6}$$