LAMPIRAN B
PERFORMANSI PELUMASAN

B.1 Persamaan *shear stress*

Persamaan shear stress model *power law* untuk fluida *non-Newtonian*

$$\tau = \eta \left| \frac{\partial u}{\partial z} \right|^{n-1} \frac{\partial u}{\partial z} = \eta_e \frac{\partial u}{\partial z}$$

dimana

$$u = \left[u_b + \left(\frac{u_s - u_b}{h} \right) z \right] + \left[\frac{(z^2 - hz)}{2n\eta \left(\frac{u_b - u_s}{h} \right)^{n-1}} \frac{\partial p}{\partial x} \right]$$

$$\frac{\partial u}{\partial z} = \left[\left(\frac{u_s - u_b}{h} \right) \right] + \left[\frac{(2z - h)}{2n\eta \left(\frac{u_b - u_s}{h} \right)^{n-1}} \frac{\partial p}{\partial x} \right]$$

saat z=h didapatkan

$$\frac{\partial u}{\partial z} = \left[\left(\frac{u_s - u_b}{h} \right) \right] + \left[\frac{(2h - h)}{2n\eta \left(\frac{u_b - u_s}{h} \right)^{n-1}} \frac{\partial p}{\partial x} \right]$$

$$\frac{\partial u}{\partial z} = \left[\left(\frac{u_s - u_b}{h} \right) \right] + \left[\frac{h}{2n\eta \left(\frac{u_b - u_s}{h} \right)^{n-1}} \frac{\partial p}{\partial x} \right]$$

Maka didapatkan persamaan *shear stress* sebagai berikut:

$$\tau = \eta \left| \frac{\partial u}{\partial z} \right|^{n-1} \frac{\partial u}{\partial z}$$

$$\tau = \eta\left(\frac{u_s - u_b}{h}\right) + \frac{h}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\left|\left[\left(\frac{u_s - u_b}{h}\right) + \frac{h}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\right]\right|^{n-1}$$

saat z=0 didapatkan

$$\frac{\partial u}{\partial z} = \left[\left(\frac{u_s - u_b}{h}\right)\right] + \left[\frac{(2.0-h)}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\right]$$

$$\frac{\partial u}{\partial z} = \left[\left(\frac{u_s - u_b}{h}\right)\right] - \left[\frac{h}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\right]$$

maka didapatkan persamaan *shear stress* sebagai berikut

$$\tau = \eta\left|\frac{\partial u}{\partial z}\right|^{n-1}\frac{\partial u}{\partial z}$$

$$\tau = \eta\left(\frac{u_s - u_b}{h}\right) - \frac{h}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\left|\left[\left(\frac{u_s - u_b}{h}\right) - \frac{h}{2n\eta\left(\frac{u_b - u_s}{h}\right)^{n-1}}\frac{\partial p}{\partial x}\right]\right|^{n-1}$$

B.2 Parameter Performansi

Ada 2 parameter yang digunakan untuk menguji performansi pelumasan *non-Newtonian*, yaitu:

a. *Load support capacity*

Load support capacity didefinisikan sebagai integral dari profil tekanan seluruh area *bearing* dan jumlah total beban yang dapat didukung oleh distribusi ketebalan film.

$$W = \int_0^l \int_0^B p(x, y)\, dxdz \tag{B.1}$$

b. Friction force

Gaya gesek dihasilkan dari sistem pelumasan karena gaya viskos fluida dan dihitung dengan mengintegralkan tegangan geser pada permukaan sepanjang area *bearing*.

$$F = \int_0^l \int_0^B \tau(x, y)\, dxdz \tag{B.2}$$

dimana,

$$\tau(x, z) = \left(\mu \frac{\partial u}{\partial z} \right)_{z=h}^{n} \tag{B.3}$$