1 **Exercise** Draw the EHL domain in Figure 3.3, where the Ertel Grubin formula is valid. Use $M_1 > 5$ and $L > 2.5$ as criteria. What happens if one uses the EG equation beyond these limits?

2 * **Exercise** Calculate the dimension of the term $\eta_0 u/w_1$. What is the consequence for the minimum film thickness h_m?

3 * **Exercise** Explain why the film thickness h_m is independent of E' in the I.R. regime. What about the dependence on α?

4 * **Exercise** Show that for the I.E. regime $h_m \propto \eta_0^{0.4}$ and $h_m \propto w_1^{0.2}$. Show that as a consequence the friction coefficient $f \propto w_1^{-0.8}$. Derive the complete equation showing the dependence of F_t with respect to all parameters η_0, R, w_1 and E'. Show through a dimensional analysis that indeed $[F_t] = N/m$.

(Hamrock Dowson, circular contact, elliptic contact)

5 **Exercise** Compare the exponents of U and W_2 in H_c^D and H_m^D. What do you conclude. Will the difference between H_m^D and H_c^D increase or decrease with increasing values of W_2 and U?

(Moes Venner 2D circular contact)

6 **Exercise** Which of the three regimes is the appropriate regime for $M_2 = 3$, $L = 0$? and for $M_2 = 100$, $L = 0$? and for $M_2 = 100$, $L = 10$? and for $M_2 = 10$, $L = 1$ (careful)? Compute for each of the cases the film thickness H_c^M.

7 **Exercise** Calculate the film thickness assuming $R_x = R_y = 30$ mm, $w = 90$ kg, $\eta_0 = 10^{-4}$ Pa s, $\alpha = 10^{-9}$ Pa^{-1}, $u_1 + u2 = 60$ m/s, $E' = 2\,10^{11}$ Pa, careful, which regime?

8 **Exercise** Derive the dimensional film thickness equation in the I.R. regime. Comment on the absence of E'. Check the dimension.

9 **Exercise** Derive the dimensional film thickness equation in the I.E. regime. Comment on the absence of α. Check the dimension.

10 **Exercise** Calculate the film thickness H_c^D and H_c^M for $W_2 = 10^{-5}$, $U = 10^{-11}$ and $G = 4000$. Compare the two values and list another advantage of the Moes parameter set.

Ertel-Grubin

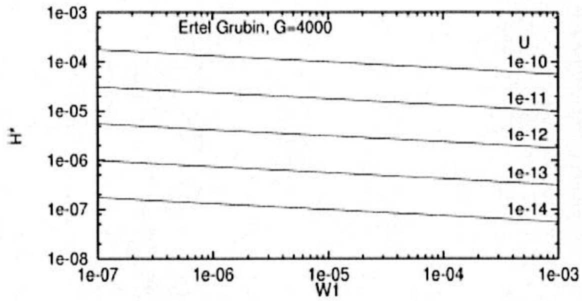

Figure 3.3 *Dimensionless film thickness H^* as a function of W_1 and U for G=4000.*

Dowson – Higginson

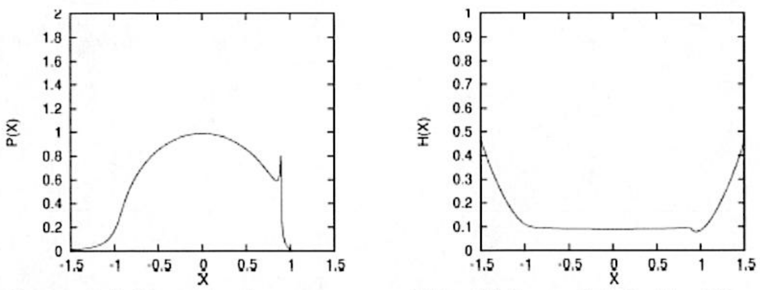

Figure 3.5 *Dimensionless pressure and film thickness distribution* $W_1 = 1.53 \cdot 10^{-4}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

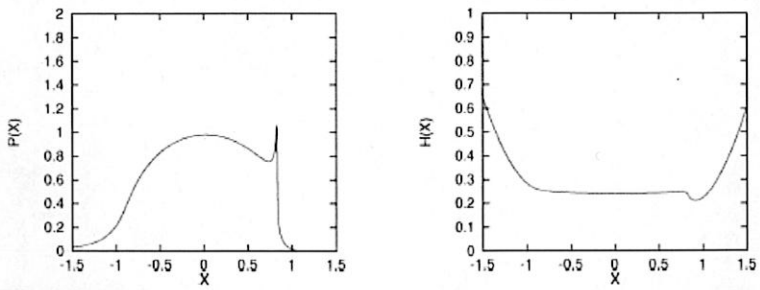

Figure 3.6 *Dimensionless pressure and film thickness distribution* $W_1 = 1.53 \cdot 10^{-4}$, $U = 2.36 \cdot 10^{-10}$, $G = 4000$.

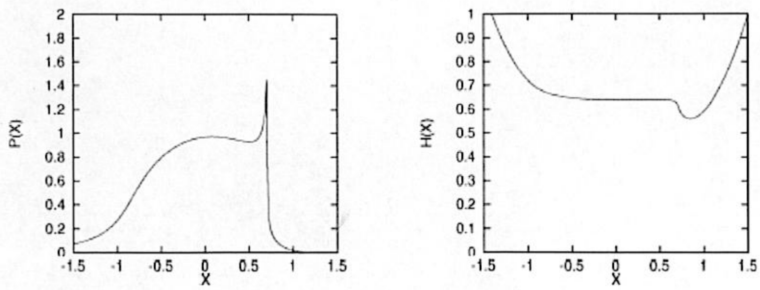

Figure 3.7 *Dimensionless pressure and film thickness distribution* $W_1 = 1.53 \cdot 10^{-4}$, $U = 9.42 \cdot 10^{-10}$, $G = 4000$.

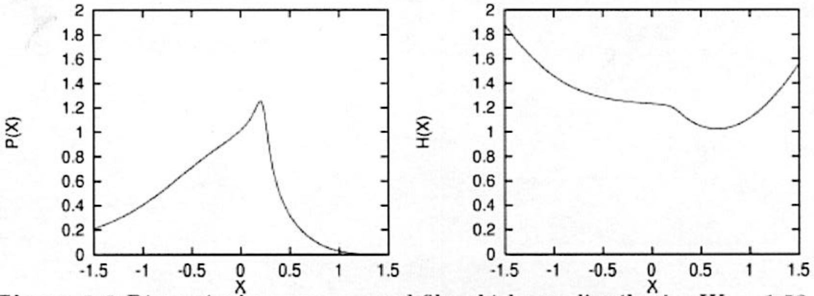

Figure 3.9 *Dimensionless pressure and film thickness distribution* $W_1 = 1.53 \cdot 10^{-5}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

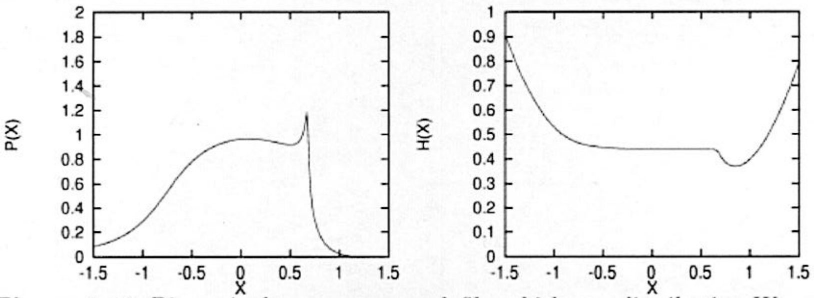

Figure 3.10 *Dimensionless pressure and film thickness distribution* $W_1 = 3.84 \cdot 10^{-5}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

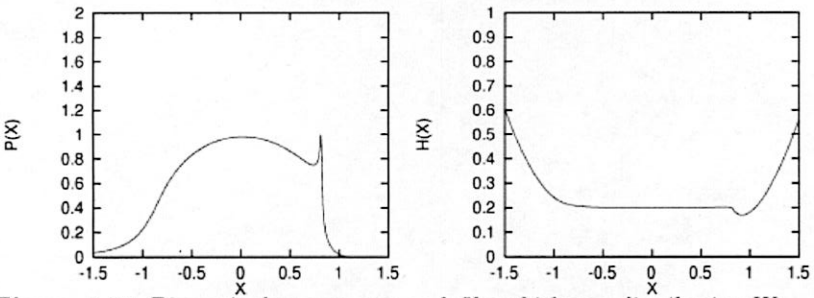

Figure 3.11 *Dimensionless pressure and film thickness distribution* $W_1 = 7.67 \cdot 10^{-5}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

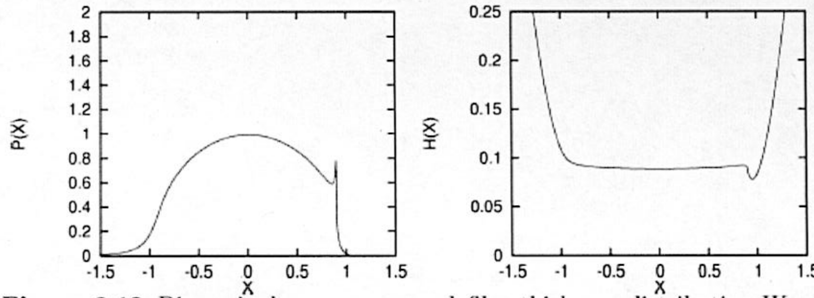

Figure 3.12 *Dimensionless pressure and film thickness distribution* $W_1 = 1.53 \cdot 10^{-4}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

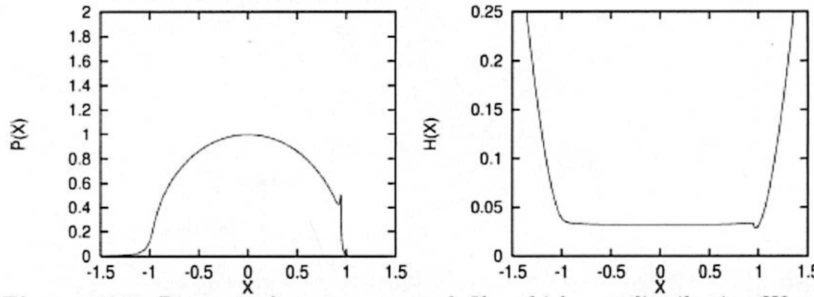

Figure 3.13 *Dimensionless pressure and film thickness distribution* $W_1 = 3.84 \cdot 10^{-4}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.

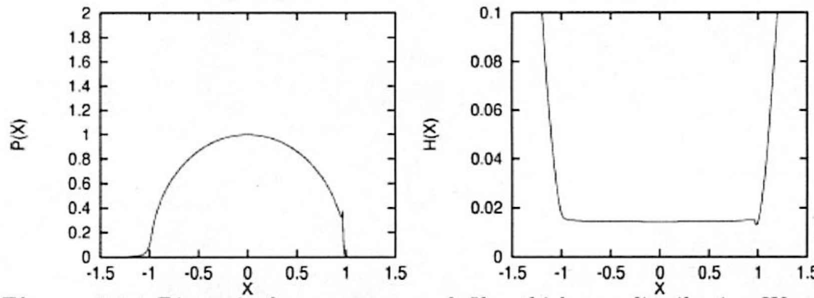

Figure 3.14 *Dimensionless pressure and film thickness distribution* $W_1 = 7.67 \cdot 10^{-4}$, $U = 5.89 \cdot 10^{-11}$, $G = 4000$.