1 **Exercise** What are the two essential phenomena in ElastoHydrodynamic Lubrication?

2 **Exercise** How to ensure the performance of an EHL contact?

3 **Exercise** If EHL contacts work reliably today, why is it necessary to continue the research to ensure reliable operation of tomorrows EHL contacts?

4 **Exercise** In a cylindrical roller bearing, is the contact between outer ring and roller conforming or non-conforming? And the contact between inner ring and roller? What can one conclude concerning the contact pressures?

5 **Exercise** Compute the reduced radii of contact for the Figures 2.3 and 2.4, if $R_{1x} = 0.1$ m and $R_{2x} = 0.09$ m. Draw the two reduced geometries to scale.

6 **Exercise** Show that the gap between two non-conforming cylinders of radii R_{1x} and R_{2x} can be described up to second order accuracy by the equation $h(x) = h_0 + x^2/(2R_x)$, using a Taylor series development, with $h_0 = h(x = 0)$ and $1/R_x = 1/R_{1x} + 1/R_{2x}$.

7 **Exercise** What are the reduced radii of contact R_x and R_y in a non-conforming contact between a sphere of radius R and a cylinder of radius R, where the cylinder axis is aligned with the x-axis.

8 **Exercise** What are the surface velocities with respect to the contact point in the case of a cylinder rolling on a flat plane with velocity u? And what are these velocities if the cylinder slides without rotation on the plane, with the same velocity u?

9 **Exercise** Give an example in which each of the three pressure generating terms is important, and describe the details of this mechanism. What happens if all three pressure generating terms are zero?

10 **Exercise** What is the Reynolds equation describing a non-rotating cylinder of radius R falling onto a stationary plane with velocity w_0. Is it possible to instantaneously generate the same pressure profile $p(x)$ using the above stationary Reynolds equation? If so what is the relation between $u_m(x)$ and w_0 at the moment the cylinder touches the plane? Assume ρ and η to be constant.

11 **Exercise** Assuming very slow transient behaviour of period τ, for which values of τ can the transient terms in the Reynolds equation be neglected. Assume that a is a typical contact dimension. Explain how in this case the transient problem can be solved as a succession of stationary problems.

12 **Exercise** Compute the elastic deformation in a line contact loaded by a parabolical pressure distribution between $-b < x < b$: $p(x) = p_0(1 - x^2/b^2)$, $-b < x < b$, $p(x) = 0$, otherwise. Take $x_0 = b$.

13 **Exercise** Check the two asymptotes of the density pressure relation.

Geometry

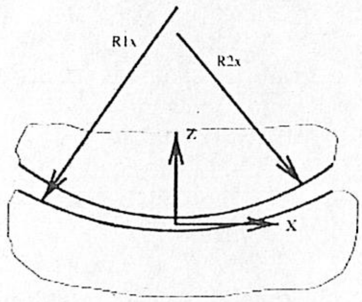

Figure 2.3 *Conforming contact.*

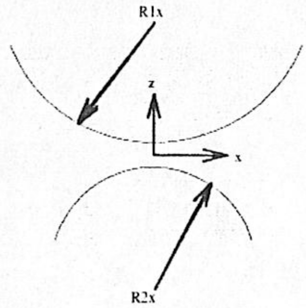

Figure 2.4 *Non-conforming contact.*

Line contact

$$h(x) = h_0 + \frac{x^2}{2R} - \frac{2}{\pi E'} \int_{-\infty}^{+\infty} p(x') \ln \left(\frac{x - x'}{x_0} \right)^2 dx'$$

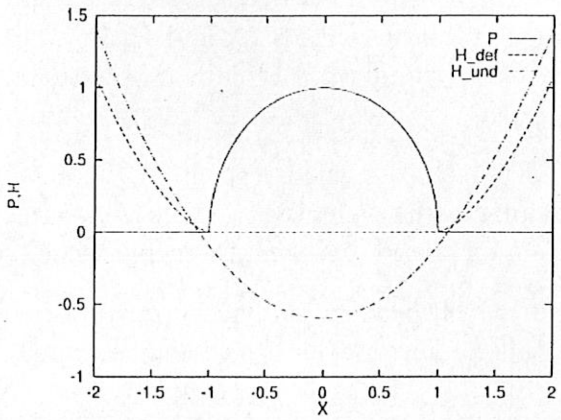

Figure 3.1 *Dimensionless Hertzian contact pressure, dimensionless deformed and undeformed geometry, for the line contact case.*

Circular contact

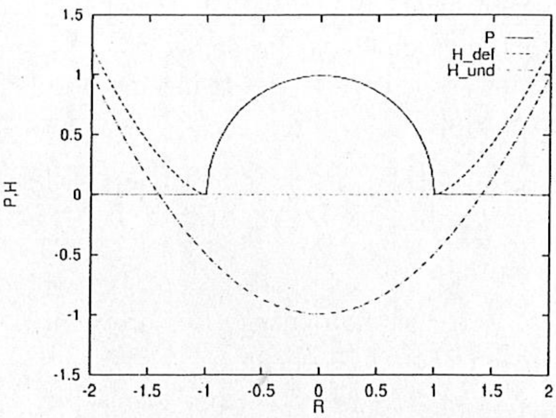

Figure 3.2 *Dimensionless Hertzian contact pressure, dimensionless deformed and undeformed geometry, for the circular contact case.*

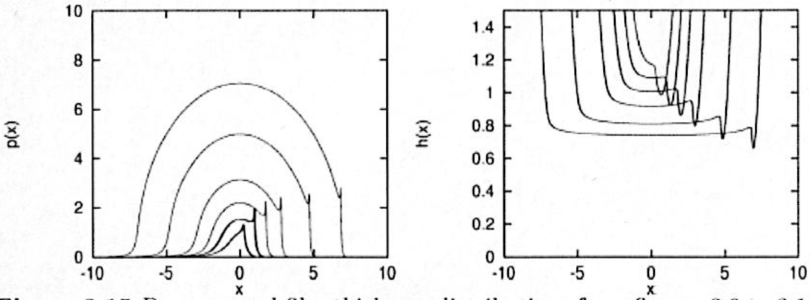

Figure 3.15 *Pressure and film thickness distributions from figures 3.9 to 3.14 (arbitrary units).*