1 How to get equation (6') in the lecture notes

$$D = d_0 - d_1(i - i_d) \tag{1}$$

$$L = l_0 + l_1(i - i_L) \tag{2}$$

$$(1 - r)D = L \tag{3}$$

$$i_L - i_d = z + ri_L \tag{4}$$

Rearrange (2) to get

$$i_L = i - \frac{L - l_0}{l_1} = i - \frac{(1 - r)D - l_0}{l_1} \tag{5}$$

because of (3). Plug this into (4) to get

$$i_L - i_d = z + ri_L = z + ri - r\frac{(1 - r)D - l_0}{l_1} \tag{6}$$

Rearrange (1) to

$$i_d = \frac{D - d_0}{d_1} + i \tag{7}$$

and subtract (7) from (5) to get

$$i_L - i_d = i - \frac{(1 - r)D - l_0}{l_1} - \frac{D - d_0}{d_1} - i. \tag{8}$$

Thus from (6) and (8) we get (RHS equal)

$$z + ri - r\frac{(1 - r)D - l_0}{l_1} = -\frac{(1 - r)D - l_0}{l_1} - \frac{D - d_0}{d_1}. \tag{9}$$

Multiply by $d_1 l_1$ to get

$$d_1 l_1(z + ri) - rd_1((1 - r)D - l_0) = (-(1 - r)D + l_0)d_1 + (-D + d_0)l_1 \tag{10}$$

Rearrange to get

$$-rd_1(1 - r)D + (1 - r)Dd_1 + Dl_1 = (1 - r)l_0 d_1 + d_0 l_1 - d_1 l_1(z + ri) \tag{11}$$

smplifying

$$\left(d_1(1 - r)^2 + l_1\right) D = (1 - r)l_0 d_1 + d_0 l_1 - d_1 l_1(z + ri) \tag{12}$$

then divide by the coefficient of D on the LHS and use the approximation to get expression (6') in the lecture notes.