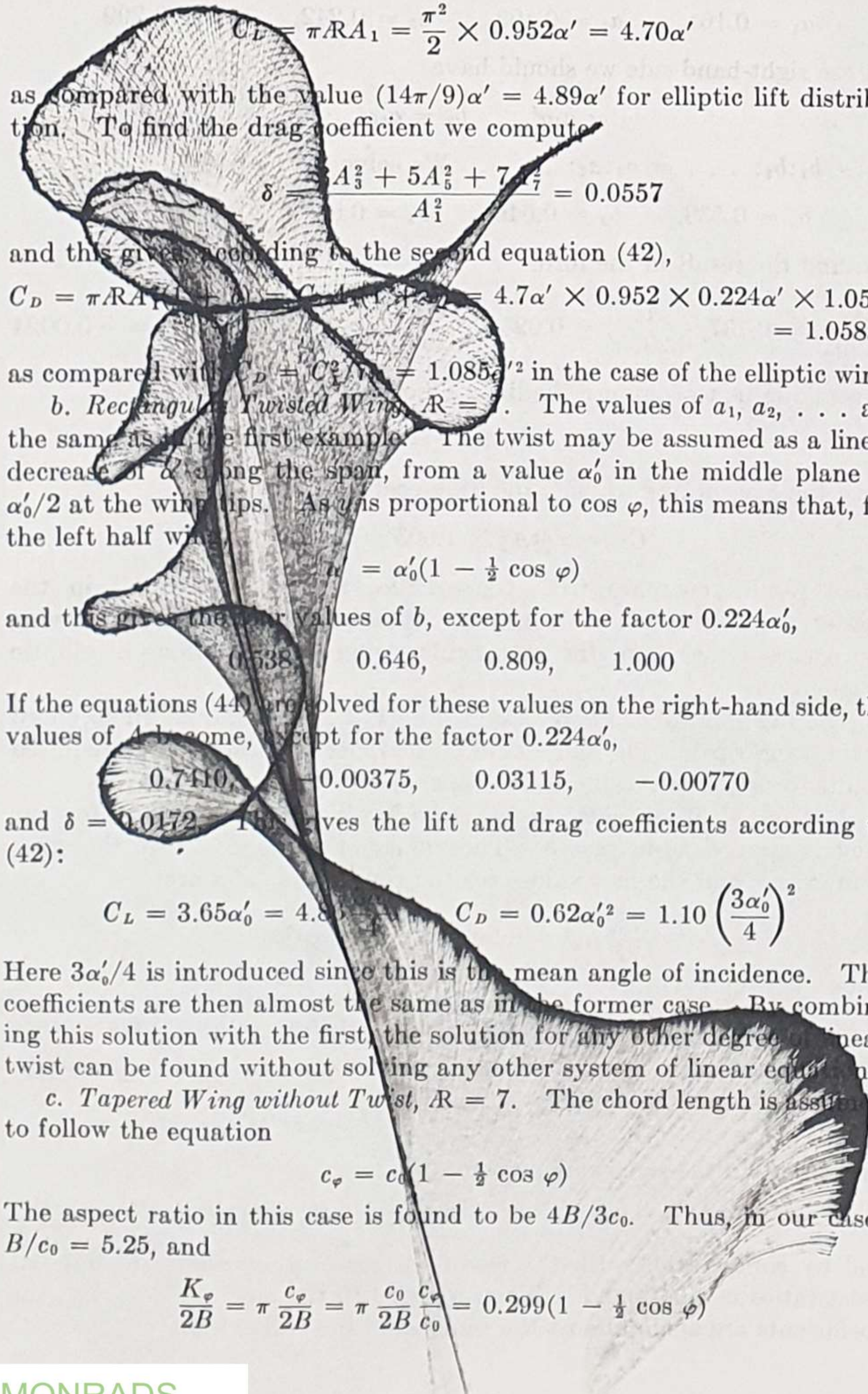

Therefore the lift coefficient, according to (42), is

$$C_L = \pi \mathcal{R} A_1 = \frac{\pi^2}{2} \times 0.952\alpha' = 4.70\alpha'$$

as compared with the value $(14\pi/9)\alpha' = 4.89\alpha'$ for elliptic lift distribution. To find the drag coefficient we compute

$$\delta = \frac{3A_3^2 + 5A_5^2 + 7A_7^2}{A_1^2} = 0.0557$$

and this gives, according to the second equation (42),

$$C_D = \pi \mathcal{R} A_1^2(1 + \delta) = C_L A_1(1 + \delta) = 4.7\alpha' \times 0.952 \times 0.224\alpha' \times 1.0557 = 1.058\alpha'^2$$

as compared with $C_D = C_L^2/\pi\mathcal{R} = 1.085\alpha'^2$ in the case of the elliptic wing.

b. Rectangular Twisted Wing, $\mathcal{R} = 7$. The values of $a_1, a_2, \ldots$ are the same as in the first example. The twist may be assumed as a linear decrease of α' along the span, from a value α_0' in the middle plane to $\alpha_0'/2$ at the wing tips. As y is proportional to $\cos\varphi$, this means that, for the left half wing,

$$\alpha' = \alpha_0'(1 - \tfrac{1}{2}\cos\varphi)$$

and this gives the four values of b, except for the factor $0.224\alpha_0'$,

$$0.538, \qquad 0.646, \qquad 0.809, \qquad 1.000$$

If the equations (44) are solved for these values on the right-hand side, the values of A become, except for the factor $0.224\alpha_0'$,

$$0.7410, \qquad -0.00375, \qquad 0.03115, \qquad -0.00770$$

and $\delta = 0.0172$. This gives the lift and drag coefficients according to (42):

$$C_L = 3.65\alpha_0' = 4.86\frac{3\alpha_0'}{4}, \qquad C_D = 0.62\alpha_0'^2 = 1.10\left(\frac{3\alpha_0'}{4}\right)^2$$

Here $3\alpha_0'/4$ is introduced since this is the mean angle of incidence. The coefficients are then almost the same as in the former case. By combining this solution with the first, the solution for any other degree of linear twist can be found without solving any other system of linear equations.

c. Tapered Wing without Twist, $\mathcal{R} = 7$. The chord length is assumed to follow the equation

$$c_\varphi = c_0(1 - \tfrac{1}{2}\cos\varphi)$$

The aspect ratio in this case is found to be $4B/3c_0$. Thus, in our case, $B/c_0 = 5.25$, and

$$\frac{K_\varphi}{2B} = \pi\frac{c_\varphi}{2B} = \pi\frac{c_0}{2B}\frac{c_\varphi}{c_0} = 0.299(1 - \tfrac{1}{2}\cos\varphi)$$