Calculation of *B, C, D* and *k*

In order to fully specify the mapping functions, we need to calculate B, C, D and k. These parameters result from the constraint that the arrangement of the electrodes in the V-plane should be symmetrical around the origin (Fig 2b). Starting in the Z-plane, the coordinates of the corners of the electrodes (z_1 to z_4, Fig 2d) are known and correspond to the physical geometry of the chip:

$$z_1 = ih, \quad z_2 = 0, \quad z_3 = s/2, \quad z_4 = s/2 + w \qquad (1)$$

where s is the insulator width and w the electrode width. The sinh transformation (eq. 11) projects them onto u_1 to u_4 (Fig 2c):

$$\begin{cases} u_1 = Sinh\left(i\dfrac{\pi}{2}\right) \\ u_2 = Sinh\left(-i\dfrac{\pi}{2}\right) \\ u_3 = Sinh\left(\dfrac{\pi s}{2h} - i\dfrac{\pi}{2}\right) \\ u_4 = Sinh\left(\dfrac{\pi s + 2\pi w}{2h} - i\dfrac{\pi}{2}\right) \end{cases} \qquad (2)$$

In the V-plane, this must become a symmetrical arrangement, with v_1=-v_4=-1/k, v_2=-1, v_3=1. Plugging all the values for u_1 to u_4 and v_1.to v_4 into the mapping function in eqn (9) yields a system of four equations:

$$\begin{cases} \dfrac{u_1 + B}{Cu_1 + D} = -\dfrac{u_4 + B}{Cu_4 + D} \\ \dfrac{u_2 + B}{Cu_2 + D} = -1 \\ \dfrac{u_3 + B}{Cu_3 + D} = 1 \end{cases} \qquad (3)$$

Solving the system of equations for B, C and D then gives the the following expression for k:

$$k = \frac{1}{v_4} = \frac{Cu_4 + D}{u_4 + B} \qquad (4)$$

Now all the parameters for the three steps of conformal mappings are determined and allow to calculate the cell constant and the distribution of the electric field in the physical structure in Fig. 2e from a simple geometry in Fig. 2a.