$$u(\boldsymbol{x}^-) = u(\boldsymbol{x}^+), \tag{2.9}$$

$$k_w \frac{\partial u}{\partial \nu}(\boldsymbol{x}^-) = k_D(\omega)\frac{\partial u}{\partial \nu}(\boldsymbol{x}^-). \tag{2.10}$$

The notation $\boldsymbol{x}^\pm$ means the inner/outer limit at the boundary of ∂D. More precisely, for a function w defined on $\mathbb{R}^d$, one has

$$w(\boldsymbol{x}^\pm) = \lim_{h\to 0} w(\boldsymbol{x} \pm h\boldsymbol{\nu}), \quad \boldsymbol{x} \in \partial D, \tag{2.11}$$

where $\boldsymbol{\nu}$ is the outward normal unit vector of ∂D.
2) The boundary conditions over the skin are a bit more complicated (see Figure 2). This is due to the fact that, compared to the water which has a conduc-

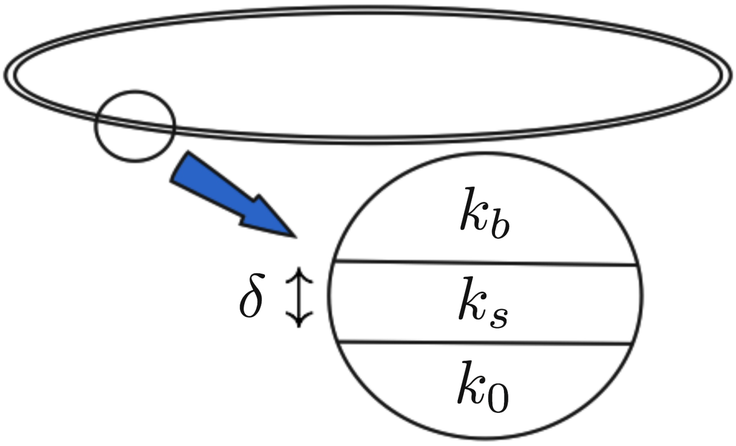

Figure 2: Boundary conditions over the skin.

tivity of the order of $0.01\mathrm{S}\cdot\mathrm{m}^{-1}$ [35], the skin is very resistive ($10^{-4}\mathrm{S}\cdot\mathrm{m}^{-1}$ [20]) and the body is very conductive ($1\mathrm{S}\cdot\mathrm{m}^{-1}$) [42]. In other words, one has

$$k_s \ll k_w \ll k_b. \tag{2.12}$$

Futhermore, the skin is very thin: if we denote its thickness by δ, we have [49]

$$\delta \approx 100\mu\mathrm{m} \ll L,$$

where L was defined as the body length in Section . In [1] we have shown in the case $d = 2$ that, when $\delta/L \ll 1$ and $k_s/k_w \ll 1$, but $\delta k_w/(Lk_s)$ is of order one (or smaller), we have the following effective relation for $\boldsymbol{x} \in \partial\Omega$:

$$u(\boldsymbol{x}^+) - u(\boldsymbol{x}^-) = \xi\frac{\partial u}{\partial \nu}(\boldsymbol{x}^+), \tag{2.13}$$