## Modeling principles

The following is extracted from Yann Boursiac, Christophe Pradal, Fabrice Bauget, Mikaël Lucas, Stathis Delivorias, Christophe Godin, Christophe Maurel, Phenotyping and modeling of root hydraulic architecture reveal critical determinants of axial water transport, Plant Physiology, 2022;, kiac281, <https://doi.org/10.1093/plphys/kiac281>

The hydraulic aspects of HydroRoot consisted in two main components: the radial water flow between the bathing solution and the xylem vessels and the axial transport through the xylem vessels. Following Doussan and colleagues (Doussan et al., 1998a; Doussan et al., 1998b), the root is discretized as a network of elementary segments consisting of a microcircuit containing both radial (*ki*) and axial (*Ki*) hydraulic conductances. The local radial flux is written as and the local axial flow as , Si and Li are respectively the surface area and the length of the elementary segments. By analogy with Ohm’s law, both 1/(*kiSi)* and *Li*/*Ki* may be modeled as electric resistances, and the hydraulic architecture may be assimilated to an electrical network (Doussan et al., 1998a; Prusinkiewicz et al., 2007). According to the boundary conditions (uniform pressure around the root and atmospheric pressure at its base), we are able to calculate the equivalent resistance of the network and then calculate the outflow rate. In brief, considering an elementary segment *i*, with and as axial and radial resistances, respectively. Its equivalent resistance is calculated as follows, assuming that the apical equivalent resistance is known:

By implementing this equation, step by step from the tips, and by considering a branched root as a parallel network, we end up with an equivalent resistance for the whole network, and as a consequence, an equivalent hydraulic conductance (Albasha et al., 2019; Prusinkiewicz et al., 2007). The basal outgoing flux (*J*v) is then calculated according to: