Discretization

The procedure of the discretization is decribed in solcore5's ofiicial webpage.

Generalized discretization

A circuit solver essentially does $N \times N$ matrix inversion, where N is the number of nodes in the circutry. The time complexity of solving matrix inversion is typically between $O(N^{2.3})$ to $O(N^3)$. We therefore implemented an approximation algorithm to reduce the number of nodes but retain reasonable accuracy.

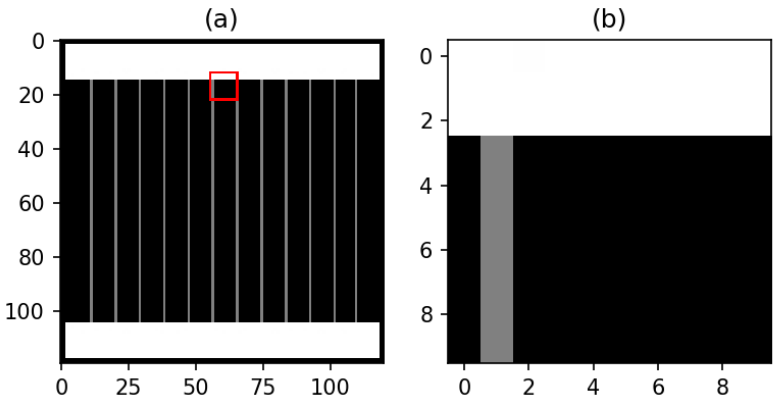

Figure 1: (a) An example of the full image of the front grid. (b) An enlarged image within the red square in (a).

The above figure (a) shows an example of the front grid, whereas (b) is the enlarged image within the red square in (a). Our aim is to merge all the pixels in (b) into a single pixel. We then have to calculate the following parameters of this merged pixel:

- contact resisatnce
- metal grid resisatnce in x- and y-direction
- metal coverage

In the meantime, the calculation the following parameter remain the same. Just be sure that the physical widths are that of merged pixel widths.

- sheet resistance
- diode parameters
- series resistance

Metal grid resistance

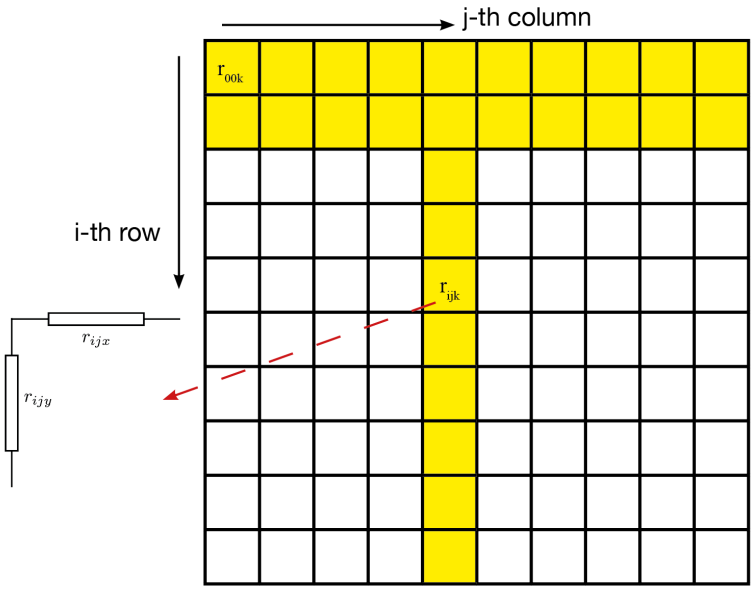

Figure 2: pixel_demo

Assume that the resistance in x- and y-direction of each pixel is R_{ijx} and R_{ijy}. The lumped resistance of the bus bar or the fingers is calculated by simply applying the resistance superposition law:

$$R_{jx} = \sum_{i=0}^{N_I - 1} Rijx$$

$$Rx = \frac{1}{\sum_{j=0}^{N_J - 1} \frac{1}{Rjx}}$$

Contact resistance

Contact resisatnce of the merged pixel is

$$R_c = \rho_c / \gamma_m$$

where ρ_c is contact resistivity (Ωm^2) and γ_m is the number of metal-grid pixels divided by the total number of pixels.