Report 0b

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One Diode Model

The Magnitude of the Electron Charge

In page 3 of [1], equation (1) was given as the implicit relation of the current and voltage through the one diode model of a solar cell:

$$I = I_0\Big(exp\big[\frac{q}{nk_BT}(V - IR_s)\big] - 1\Big) + \frac{V - IR_s}{R_{sh}} - I_{ph} \qquad (1)$$

By applying Kirchhoff's laws, I was able to obtain the same expression but the diode current relation as given in [2] does not contain the magnitude of the electron charge (q).

IEEE-754 floating point arithmetic

Python as most other programming languages uses IEEE-754-2008 standard for float type computations where the maximum achievable number is around 10^{323} as mentioned in [1] which utilizes 53 bits for representing numbers. I am still not sure about the possibility of using quadruple precision floating point in Python.

Methodological Note (page 11)

I would like to know what is the used software package which is claimed to have no limitation on numerical magnitudes. Also, what are the intermediate values of interest that would give information about the arithmetic overflow (exactly which terms of the equation). Last point here is the high water mark filter which I did not understand clearly.

Two Diode Model

Same procedure were taken to implement (in Python) the two diodes model of a solar cell that was given in [1]. The so called S-shape anomaly was not achieved by using both explicit voltage equations. Overflow is acceptably encountered in the case of equation (7) but for the proposed equivalent expression "equation (15)" the overflow seem to occur at the second term within the $g(x_1)$ and $g(x_2)$ functions.

References

[1] On Calculating the Current-Voltage Characteristic of Multi-Diode Models for Organic Solar Cells

[2] Exact analytical solution of a two diode circuit model for organic solar cells showing S-shape using Lambert W-functions