pyRFtk

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Summary

In the field of nuclear fusion, the most prominent sources of both heating and wall conditioning are radio frequency heating. More particularly Ion cyclotron resonance heating and electron cyclotron heating. As such the understanding of the circuitry involved and how to maximize the antenna-plasma coupling needs to be thoroughly understood.

Statement of need

'pyRFtk' is a python package for simulating RF circuitry. PyRFtk is built on the principle of connecting various blocks such as transmission lines and touchstone files into a circuit, making it easy to design most circuits imaginable and examine them.

The program was designed to be used by experienced RF engineers needing to analyse an RF circuit but also made straightforward enough to be usable by people new to the field. Even though the software is new to the open-source landscape, it is under active development since 19?? and has appeared in numerous papers [@??]

Mathematics

The program solves the telegrapher's equations, i.e assuming that the conductors are composed of an infinite series of two-port elementary components.

The telegrapher's equations in the time domain are :

$$\frac{\partial}{\partial x}V(x,t) = -L\frac{\partial}{\partial t}I(x,t) - RI(x,t)$$
$$\frac{\partial}{\partial x}I(x,t) = -C\frac{\partial}{\partial t}V(x,t) - GV(x,t)$$

Which can be combined

Double dollars make self-standing equations:

$$\Theta(x) = \begin{cases} 0 \text{ if } x < 0 \\ 1 \text{ else} \end{cases}$$

You can also use plain LaTeXfor equations

$$\hat{f}(\omega) = \int_{-\infty}^{\infty} f(x) e^{i\omega x} dx \tag{1}$$

and refer to Equation 1 from text.

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References