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Motions of light and electromagnetism on Schottky diodes in Photovoltaic panels, in analogies with noncircular orbits

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Introduction

Photovoltaic is found in various applications, e.g. in Italy at ceramic plates on roofs. In Strömberg and Soualmia (2017), an overall description of a Photovoltaic panel and solutions to heat equations were derived. The entire electromagnetic device establishing contact with the Sun-light in motion, was considered a fractal with activity on different scales.

A photovoltaic panel consists of solar cells, so called Schottky diodes, SD, which produce voltage and current when exposed to sunlight, c.f. Wikipedia and Figure 1. Here, heat and current in one SD will be considered. In Soualmia and Chenni (2016), Solar Cells in a panel are analysed with the software PVsyst, to model the effects of partial shadings. Each cell is represented by an equivalent electrical circuit including also output load. From applications, it is found that, apart from partial shading, there are also distributions when temperature gets localized to a hot-spot.

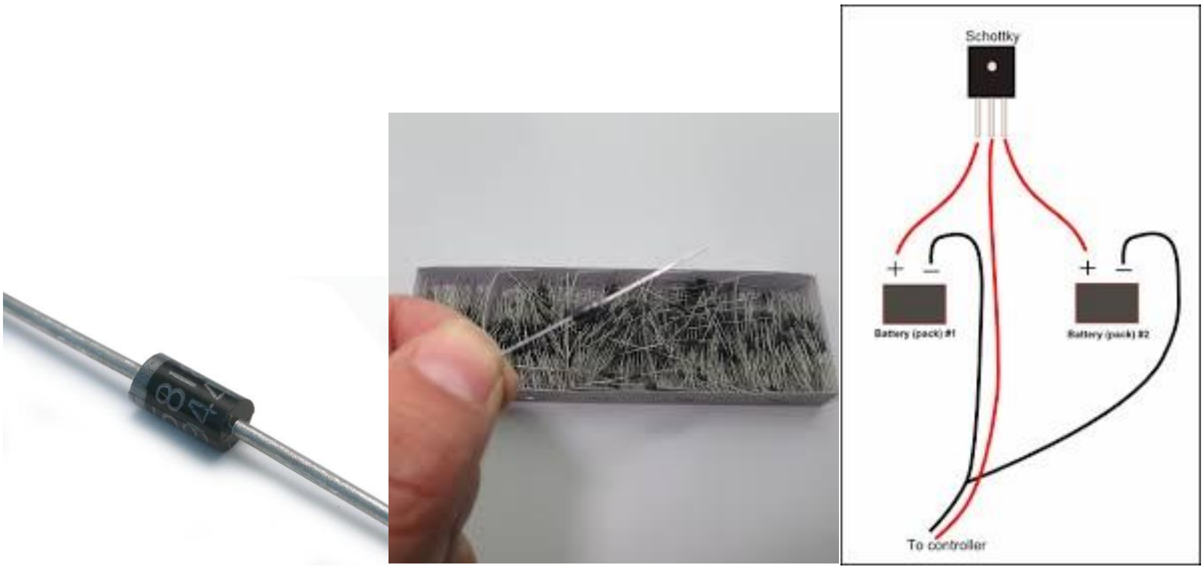

Figure 1. Schottky diodes. Left and middle, two pinned. Right figure; a three pinned, where pn-diffusion inside may have a more curved behaviour.

Over-heat model for one SD

For the component per se, the normal operation is to produce current in the inline direction, and if shaded, collect the current from upstream. These are desired features, but it may instead get over-heated, and grilled as described in Soualmia and Chenni (2016).

Overheat is probably promoted by activity in radial direction, such that heat is collected close to the surface and do not activate the pn-transition of the semi-conductor. Such activity may emanate from

*rate of shadowing

*bifurcations in behaviour of resistivity

In wiki, size effects are discussed and it is concluded that current scales with area, while the build in shunt resistivity depend on circumference. In view of that, the behaviour may depend on the diffusion time for the material, and other parameters for heat conduction.

Next, mechanisms resulting in heating will be cast into details.

Model of radial heat wave with concepts from noncircular orbits

When the radial input of solar heat varies for example due to rate of shading, it induces a noncircular orbit, (abbreviated nco), in circumferential direction. This may depend on the inline motion, which has a much larger radius. Characteristic properties for this new orbit may then be increased according to the format in Avd; Strömberg (2015), where the smaller radius enters in the denominator. The new state may follow a scenario given by interpretation of the results in Strömberg (2016) and Strömberg et al (2017). These are concluded in terms of wave motion and assuming ratios common in acoustics.

When first an increased input, the motion of 'heat' is that of a traveling wave. This correspond to f=1, where the nco contributes to the traveling wave propagation. The large ratio 1.4 is possibly chosen since it is obtained by two different intrinsic times, and it gives that the wave travels a long distance, if the front occasionally appear at that location. It could also be a reflection of a wave with a lower ratio. Then it organize into a nco with eccentricity ratio 0.4 and f=2, which could be a stationary wave. At a minimization of d.o.f, this corresponds to the octave (tide). Then if dissipation, also the duodecima could be obtained, and then it is still this process that rules, instead of current production. With a new input from rate of shadow, either this can maintain or the inline activity of pn-transition may conquer.

The latter process will begin if the temperature of the Schottky diode is distributed inside with diffusion instead of wave motion and reduced such that it functions normally.

The acoustic radial state could be present when too much, i.e. enough energy, as an organisation of chaos. Therefore, in order to get the desirable function i.e. collection of current and voltage, chaos should be avoided or organised into the inline collection.

Magnitudes and distributed electric fields

A 'walk-down' analysis and comparison with an eye, gives that arcs and spheres should be more efficient to collect light energy, in general. Benefits of alternate designs were argued for in Strömberg and Soualmia (2017).

Models for Solar cells are given in Wikipedia, in terms of electrical schemes, and a related equation. It is indicated that the density of current and resistors, is more accurate, and the equation is rewritten with properties that are distributed.

Cohomology of noncircular orbits and electromagnetism

A simple assumption for distribution is as a small arc, and assuming this as part of a noncircular orbit. Ohm's law and Maxwell's equation gives a relation invoking additive relation between current and rotation of magnetism. At induction, current occurs in circular coils when subjected to a magnetic field that varies with time. Both cases involve fields on a curved path, and we will assume that the angular velocity in Avd; Strömberg (2015), will corresponds to the rotation of such fields.

Iteration map for electricity production

For the operational function of producing current, we assume an equation of states, as in Strömberg and Jones (2017). The format is valid when w_0t is small, i.e. changing to a spatial description, when w is confined to a small arc. An increased length of diodes or a larger curvature may change the conditions for the iteration map. When a curvature, the concept of nco may be even more governing, and next, some implications will be analysed.

In Strömberg and Jones (2017), an iteration format is derived and angular velocities are obtained as fixed points. Here, the results will be applied to electricity produced of the semiconductor in the SD. Chaos, is present above a certain limit (parameter A), which possibly depends on the heat energy input.

At first bifurcation, the frequency ratio is 1/3. Hereby, the distribution on an arc is determined, and decreases from w_0 to $w_0/3$. Then, the maximum production of current for each Solar cell is determined, however this conclusion is based on several assumptions.

After the bifurcation, one state may be a process in radial direction, which causes over-heat as described above.

Concluding Remarks

First, the conditions at over-heat were addressed, assuming a wave motion at the surface, such that heat and temperature do not distribute, produce inline current and decrease, as desired.

Then, a state model for current production was outlined with the following preliminaries and results: Normal operation of a diode was modeled with rotation of a field (∇^{x}) assumed similar to the angular velocity of a noncircular orbit, which was related to electromagnetism with an analogy. The collecting of heat and production of current was assumed as an iteration map. This gives unique solutions below a certain limit, and above, the over-heat process may be ruling.

An analogy with electromagnetic properties, was obtained from the format of Maxwell's equations, given by $\nabla^{x}\mathbf{H} = \mathbf{J}_f+\mathbf{D}_{,t}$ or $\nabla^{x}\mathbf{B} =(4\pi\mathbf{J}+\mathbf{E}_{,t})/c$

From the data in Wikipedia, it is seen that the SD performs better at lower temperatures. It may be since not so many other states than the desirable of producing inline current.

The wave front model, where sidereal rotation participate, is also notified for a ball with spin such that it contributes at forward spin, and vice versa; so-called Magnus effect. This justifies using noncircular orbits as modeling concept.

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