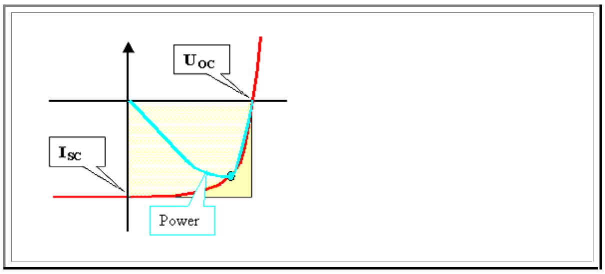
Solution to Exercise 8.1-2

Optimal Working Point of Solar Cells

The figure shows the ***IV***-characteristics of a real solar cell. Derive the optimal working point by simply constructing the ***I · U =*** Power curve graphically

Illustration



- This is easy. Power is ***P = U · I***; as long as the current is relatively constant, the power curve is a straight line from the origin.
- At U_{OC} the power is zero; for voltages a bit smaller it will go up sharply. All in all the power curve must look like the blue curve with the point of maximum efficiency somewhat below U_{OC}

- What kind of load resistor would you need for this solar cell? What are the implications ?

- In full sun light a **(15 × 15) cm^2** solar cell delivers something like **5 A** at **0.5 V**, calling for a load resistor with R_{load} **= 100 mΩ**. It the current drops by a factor of **10** because of clouds, the load resistor must increase **10** fold, otherwise the voltage drops below the optimum value .
- This means that not only do we have very small (and difficult to handle) load resistors, we also need an active load management if maximum power is to be harvested from solar cells with necessarily strongly changing output.