**L5: Maximum Power Transfer Theorem**

* **background**

In some circumstances, it is interested to determine the maximum power that can be delivered to a load in a circuit. From this point of view, the circuit consists in a load connected to a dipole, from which the load gets the power. A dipole is a network with two access terminals. Accordingly to Thevenin’s theorem, a dipole can be replaced by an equivalent circuit that contains only a voltage source ( *eTh* ) in series with a resistor ( *RTh* ).

*i*

*R*

**Active**

**Linear**

**Dipole**

(*a*)

(*b*)

*eTh*

*R*

*RTh*

*i*

(*a*)

(*b*)

**<=>**

The maximum power transfer theorem states that maximum power transfer takes place when the load resistance is equal with the equivalent resistance of the dipole that delivers its power.

Let’s consider the generic equivalent circuit with following notations:

*eTh*

*R*

*RTh*

*i*

(1)

(1’)

(2)

(2’)

*v1*

*v2*

*  source voltage
*  load voltage
*  dropped voltage
*  generated power
*  delivered power
*  power transfer efficiency
* **experimental procedure**

**1)** Build the circuit.

**2)** Do measurements for ***i*** and ***v2*** in this way: start with the worse case operating conditions which is the short-circuit for the load, continue with normal working conditions which means finite non-zero values for load, and finish with open-circuit regime.

**3)** Calculate the other quantities. Notice the maximum power delivered and the corresponded transmission efficiency.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| load | short-circuit | . . . . some intermediary finite values, at least 6 values . . . . | | | open-circuit |
| ***i***  (mA) |  |  | . . . . |  |  |
| ***v* 1**  (V) |  |  | . . . . |  |  |
| ***v* 2** (V) |  |  | . . . . |  |  |
| ***P*1** (mW) |  |  | . . . . |  |  |
| ***P*2** (mW) |  |  | . . . . |  |  |
| ***η*** |  |  | . . . . |  |  |