DAMPING RESISTORS IN HARMONIC FIL TERS

In order to control the impedance in a electrical system with harmonic current generation filter circuits are used. They allow to fix a low impedance at defined fixed frequency independent of the network.

In order to build such filters the traditional electro technology offers the use of capacitors and inductors. By connecting this two elements in various configuration a well defined frequency response can be achieved. How ever the available components do have a very high quality factor, that means very low losses. This results in a system which is also very susceptible for undesired resonance's, or poor performance with variable frequency.

In this cases resistors can help to improve the behavior. They act as damping elements in a oscillating system, similar to the shock absorbers in the suspension of a car, where the springs and the mass of the car can be compared to the reactors and the capacitors in the electrical system.

With adequate circuit design losses at fundamental frequency can be avoided and optimum results at harmonic frequency can be achieved. In general they smoothen the response at the tuning frequency in order to increase the immunity to frequency variation and component tolerances due to manufacturing and temperature. At the parallel resonance frequency they control the dynamic behavior of the filter in order to avoid critical amplification of residual non typical harmonics and general noise.

At this point a resistance with variable ohmic value can have a significant positive influence on the filter characteristic.

At low harmonic distortion the resistance shall have a low value. This increases the damping of the system during unpredictable transient phenomena in the network like energisation of parallel circuits, transformers or the filter itself. With a low value in the resistor the switch on transient of the filter can be kept very short and we have maximum security in the system.

At increasing harmonic currents the resistor should have a high value in order to reduce the impedance of the filter at the tuning frequency and improve the voltage quality for steady state harmonic current.

This behavior can be achieved by using a resistor with a high positive thermal coefficient for the resistivity. At low harmonic loads the resistor does not have any loss and is therefore at a low value. With increasing absorption of harmonic currents the resistive value increases and the filter quality improves.

Now it is up to the designer to chose the right compromise between transient damping and harmonic absorption. But it general it can be said it is always useful to have a positive coefficient even if it is only for the transient of filter energisation.

Roger MATHYS, Ennetbürgen, 20.11.2000