



Protection of Power Semiconductors in Inverters, using Fuses and their Coordination with the Protection Schemes of the Distribution System

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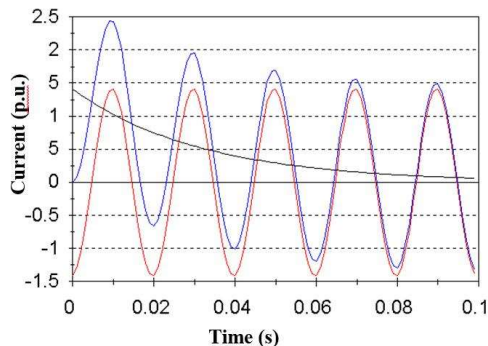
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Introduction

The integration of Distributed Energy Resources implies an important challenge for the protection of the distribution network, due to the incorporation of devices with less capacity to withstand normal disturbances, particularly in front of overcurrents and overvoltages. The increasingly widespread use of power electronics, incorporated in rectifiers and inverters, which due to its weakness requires high-speed protection devices, complicates coordination with the traditional protection of distribution systems.

Short Circuit Current and Fault Current Asymmetry



Components of direct, alternating and resulting fault current

Characteristics of Power Electronic Devices

Today's semiconductors have the characteristic of being capable of conducting high load current values, moreover, they are very weak to overcurrents and overvoltages. The information of this semiconductor capacity or ability, is one of the parameters that must inevitably be controlled by the fuse.

Characteristics of the Ultra-fast Fuses

In general, fuses in distribution systems have a very high breaking capacity, but they have limitations in the

interruption of slight overloads. Thus, the aR and gR classes appear in contrast to those traditionally used in distribution systems. The response characteristics of these ultra-fast fuses, oblige the professional in charge of the protection of the distribution system to have a deep knowledge about the behavior of the power electronics in the face of overcurrents, and to know how the fuses, through the selection of its rated values and characteristic curves protects it.

Due to the complexity of this application, the fuses must have more complete operating information.

Protector – Protected Coordination

The protective-protected coordination task is based on confirming that the stress allowed to pass through the protector fuse does not exceed the energy supported without damage by the protected device and also that the overvoltages generated in the limiting operation case do not damage the devices connected in parallel with the protected one. In other words, the coordination work is a simple comparison of the parameters of both devices.

Coordination of Ultra-fast Fuses with other Protective Devices

The coordination between protective devices against overcurrent is based on the comparison of the characteristic time - current curves, which here is applicable only in the validity zone of the homologous curve of the semiconductor. For high fault currents, the ultra-fast fuse will always operate before the distribution system device, although if they are needed, they can be coordinated based on the I^2t values affected by the corresponding correction factors.

Conclusion

It is concluded that in-depth knowledge of the dissimilar characteristics of power electronics devices and the usual devices of distribution networks, with regard to their protections, are essential to obtain maximum use of the traditional scheme with the addition of distributed renewable sources.