

Lightning Overvoltages due to Direct Strikes to a Hybrid Overhead Line

Luana Batista Moraes^a, Alexandre Piantini^a, Miltom Shigihara^a, Alberto Borghetti^b, Fabio Napolitano^b, Carlo Alberto Nucci^b, Fabio Tossani^b

^a Institute of Energy and Environment, University of São Paulo, Brazil

^b Department of Electrical, Electronic and Information Engineering, DEI, University of Bologna, Italy

Abstract

This paper analyzes the overvoltages caused by direct lightning strikes to a hybrid overhead line with sub-transmission (138 kV), medium-voltage (13.8 kV), and low-voltage (220 V) circuits. The main focus is on the influences of various parameters, such as the lightning current front time, the ground impedance, and the tower surge impedance, on the overvoltages in the medium-voltage line. Specific models of transmission line towers and high-voltage insulators were developed and validated through laboratory tests and EMTP simulations. The analysis indicates that the line performs well against backflashovers.