ABSTRACT

Lightning strikes to man-made systems can include lightning strikes to telecommunication subscriber lines (TSLs) and electrical power lines, the two systems that are almost always affected by nearby lightning activities. Better designs of lightning protection systems can be realised if data on lightning strike distribution in a given region is known. Lightning mapping or locating systems can be based on several of technologies [1,2]. The two most popular methods are those based on the Time of Arrival (ToA) and the Directional Finder (DF). The Malaysian wide lightning locating system (LLS) owned by TNB is known to be able to determine the coordinate of the cloudto-ground lightning strike within 500m accuracy. In this chapter, we will propose a new method to determine the coordinate of any cloud-to-ground lightning strike within a certain local region with an improved accuracy of up to within 20m. Although the covergae area of our new system is much smaller than the LLS, it can be used for specific local needs as well as to function as a calibrating system for the LLS. This new LLS is based on the measurement of induced voltages due to lightning strikes in the vicinity of an existing overhead telephone lines [3, 4, 5, and 6]. Many studies were done by several researchers in relation to the lightning induced voltages and their models. Diendorfer [7] numerically calculates the wave shape of the induced voltage on an overhead line due to nearby lightning return stroke by solving the transmission line equation using Agrawal's time domain approach [3]. The return stroke's vertical and horizontal electric fields were calculated using the travelling current source model. The same method is applied to calculate the induced current and voltage on the inner conductor of shielded cable [8]. Pokharel [9] studies the transient-induced voltages on a distribution line over finitely conducting ground. Using a different method, Piantini [10] studies the lightning induced voltages on overhead lines of power distribution systems using the scale model technique which are prohibitively complex to be treated theoretically. The contribution of the electromagnetic field components in field-to-transmission line interaction based on the transmission line approximation using three different equivalent formulations was studied by Nucci [11]. The effect of distances and height of TSL to lightning strike position was studied in [12] and the induced voltage in a complex TSL as well as a simplified wire model was studied in [13]. Other studies include the observation of lightning surges induced in a telecommunication building [14], the effect of strike locations along the telecommunication line on the amplitude and shape of the induced voltages [15], and the calculation of corresponding electromagnetic fields from known lightning sources [16]. The experimental approach to test the theory of lightning induced voltages on an overhead wire was carried out in [17,18]. In this work, the time difference of arrival method is implemented in a localised lightning locating system, in particular, to calculate the lightning strike coordinate based on the lightning induced voltage timing information measured from a purposely installed telephone overhead lines.