ABSTRACT

Failure of power transmission lines usually lead to huge economic losses, such failure may occur due to many reasons such as conductor breakage, or failure of any of the line components, or under severe conditions such as wind, thunderstorms, tornadoes, ice storms *etc.* Transmission towers design is a main concern for designers where one of the most important load cases in the design is an electrical conductor unbalanced longitudinal load. In general, designers always neglect longitudinal loads assuming that these loads at the two sides of the tower are nearly equal. But this equality can be easily broken from several events such as wind loads, conductor breakage scenario, or failure of the tower. This study presents two scenarios, the first is the effect of vibration of conductive cables on the transmission towers stability due to dynamic wind loads near wind farms which was simulated using a FORTRAN code. The second scenario includes loading wind loads calculated using ASCE 74 guidelines on the transmission line system followed by a broken conductor scenario, and consequently its effect on the tower. A numerical model using ADINA and SAP2000 software was created to model the tower and the transmission line interactive behavior. Incremental nonlinear dynamic analysis was carried out in the time domain using ADINA software. The study results indicated failure of the tower in the two scenarios, the failure started in the tower cross arms followed by the failure of the transmission tower mast. The study showed that when the balance at the two sides of the tower is broken due to wind loads or conductor breakage, failure of the tower will take place and this might lead to a cascade failure of a large part of the transmission line as a worst case scenario.