



MODELING OF EFFECT DUE TO LIGHTNING STRIKE ON ELECTRICITY POWER SYSTEM USING DIFFERENTIAL EQUATIONS

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ABSTRACT

The electricity power system (EPS) consists of electrical generators, transformers, transmission lines, distribution lines and power consumers. Lightning is one of the main causes of EPS fault. Electrical devices in the EPS work at a certain voltage range. These devices blow up or get damaged when they receive a voltage way higher than the specified voltage sufficient for their operation. Problem of the research is to study about the changes of the existing current of the EPS due to lightning current. The objective of this study is to model effect due to lightning strike on EPS. Existing EPS is a major circuit consists of many resistors, capacitors and inductors. RLC circuit is an electrical circuit consists of a Resistor(R), an Inductor (L) and a Capacitor(C). So EPS can be simplified to a RLC circuit. Instead of EPS, RLC circuit is used to model effect due to lightning strike on EPS. In real situation lightning impulse struck on the EPS. Instead of that real situation, existing current and lightning current are combined to model the impact of lightning on EPS. Behavior of the circuit can be represented by a differential equation with the help of Kirchhoff's rule. Normally EPS has an Alternating Current (AC current). So AC voltage source is supplied as voltage source in RLC circuit to get circuit current. Lightning impulse voltage is used as voltage source in RLC circuit to get lightning current. Circuit currents are obtained by solving differential equation. Then these two currents are combined to model the impact of lightning on RLC circuit. When lightning impulse struck on a RLC circuit with AC voltage supply, effect of the circuit current is modeled using Maple software. RLC circuit current waveform is totally changed when lightning impulse struck on the circuit. Circuit current is reached to peak value instantly with the effect of the lightning current and it drops with fluctuations. Similarly, existing current wave form in the EPS totally differs when lightning impulse struck on the system. Electrical devices are getting damaged because of the changing of their current for the effect of the lightning current.

Keywords: Differential Equation, RLC circuit, Lightning impulse, Kirchhoff's Rule