

Saluran transmisi udara tegangan tinggi rentan terhadap gangguan sambaran petir yang dapat menimbulkan tegangan lebih transien dan memicu terjadinya *backflashover*. Dalam simulasi transien elektromagnetik, respons transien yang dihasilkan akibat gangguan sangat dipengaruhi oleh pendekatan pemodelan komponen sistem pada perangkat lunak simulasi. Penelitian ini menganalisis dan membandingkan respons transien saluran transmisi 765 kV akibat sambaran petir menggunakan variasi pemodelan pada sistem pentanahan, untaian isolator, dan struktur menara dengan perangkat lunak EMTP-RV. Model dasar dari pustaka EMTP/Lightning_and_GIS dibandingkan dengan model berbasis literatur, meliputi pentanahan *non-linear*, model untaian isolator *leader progression*, serta struktur menara *multistory*. Simulasi dilakukan dengan menginjeksikan arus petir model CIGRE sebesar 200 kA dengan bentuk gelombang 3/100 μ s pada kawat tanah.

Hasil simulasi menunjukkan bahwa perbedaan pemodelan menghasilkan respons transien yang berbeda. Model pentanahan *non-linear* menurunkan tegangan lebih pada pentanahan, namun tidak secara signifikan menghilangkan kemungkinan terjadinya *backflashover*. Perbedaan paling dominan terjadi pada pemodelan untaian isolator, dimana model *flashover switch* memprediksi terjadinya *flashover*, sedangkan model *leader progression* tidak. Selain itu, model struktur menara *multistory* menunjukkan karakteristik redaman yang lebih baik dibandingkan model *lossless transmission line*.

Kata kunci: Tegangan lebih petir, saluran transmisi, *flashover*, EMTP, sambaran petir

High-voltage overhead transmission lines are vulnerable to lightning strikes, which can generate transient overvoltages and trigger backflashover. In electromagnetic transient simulations, the resulting transient response to such disturbances is strongly influenced by the modeling approach adopted for system components within the simulation environment. This study analyzes and compares the transient response of a 765 kV transmission line subjected to lightning strikes by applying variations in the modeling of tower grounding, insulator strings, and tower structures using the EMTP-RV software. The base model from the EMTP/Lightning_and_GIS library is compared with literature based models, including a non-linear grounding model, an insulator string model based on leader progression, and a multistory tower structure. Simulations are performed by injecting a CIGRE lightning current with a peak amplitude of 200 kA and a $3/100 \mu\text{s}$ waveform into the overhead ground wire.

Simulation results indicate that different modeling approaches lead to different transient responses. The non-linear grounding model reduces the overvoltage at the tower grounding; however, this reduction is not sufficient to significantly eliminate the occurrence of backflashover. The most pronounced difference is observed in the insulator string modeling, where the flashover switch model predicts the occurrence of flashover, whereas the leader progression model does not. In addition, the multistory tower model exhibits better damping characteristics than the lossless transmission line model.

Keywords: lightning overvoltage, transmission line, flashover, EMTP, lightning strike