

Free ebook Transmission lines ac (Read Only)

most north american transmission lines are high voltage three phase ac although single phase ac is sometimes used in railway electrification systems dc technology is used for greater efficiency over longer distances typically hundreds of miles key learnings transmission line definition a transmission line is a designed conductor that carries large volumes of electrical power across large distances at high voltages line types and lengths transmission lines are categorized by length short lines are under 80 km medium lines between 80 and 250 km and long lines over 250 km multi conductor cables with capacitance between conductors allow current to flow momentarily when the applied voltage changes such as with an ac waveform transmission lines are designed with specific impedances of 50 ohms 75 ohms etc which create a predictable current draw for certain frequency ranges regardless of cable length surges on transmission lines sinusoidal steady state a transmission line is really a long continuous thing it has inductance which is really inductance per unit length multiplied by the line length but it also has a continuous capacitance conductors on transmission lines carry 3 phase ac power with voltages exceeding 765 kv on the most modern ultra high voltage lines insulators prevent lines from shorting to each other or ground circuit breakers switches and reclosers provide protection and system control an example of an acsr aluminum cable steel reinforced transmission line the center strands are steel with aluminum outer strands image by clarkmills cc by sa 3 0 as one can imagine key differences between ac and dc transmission line the ac transmission line transmits the alternating current over a long distance whereas the dc transmission line is used for transmitting the dc over the long distance the ac transmission line uses three conductors for long power transmission in the u s nearly all transmission makes use of overhead ac lines these cables are good but not perfect conductors series impedance shunt admittance in this section of notes we ll look at how these are accounted for in equivalent circuit models electrical properties of transmission lines 4 series resistance engineers design transmission lines with a specific characteristic impedance to minimize these effects and ensure efficient power transmission this parameter measures the line s opposition to alternating current ac flow at a particular frequency skin effect is a phenomenon that occurs in transmission lines when an ac current flows through a conductor it causes an uneven distribution of current over the cross section of the conductor with more current flowing near the surface than near the core the 3 phase 3 wire overhead high voltage transmission line next terminates in step down transformers in a substation known as receiving station r s which usually lies at the outskirts of a city because it is not safe to bring high voltage overhead transmission lines into thickly populated areas here the voltage is stepped down to 33 kv introduction to transmission lines part ii dr farid farahmand fall 2012 transmission line model perfect conductor and perfect dielectric notes simulation example transmission line model transmission line equations remember kirchhoff voltage law $v_{in} - v_{out} - v_r - v_l = 0$ kirchhoff current law $i_{in} - i_{out} - i_c - i_g = 0$ note electric power can be transmitted in both ac and dc for short and long transmission and distribution systems there are some advantages and disadvantages of both systems let s discuss the technical advantages and disadvantages of both ac and dc power transmission lines systems table of contents this report looks to explain and quantify the two major sources of loss in high voltage ac

transmission lines resistive loss and corona loss the former occurs because of the non zero resistance found wire s metal corona loss is an ionization of the air that occurs when the electric fields around a conductor exceed a specific value in electrical engineering a transmission line is a specialized cable or other structure designed to conduct electromagnetic waves in a contained manner the term applies when the conductors are long enough that the wave nature of the transmission must be taken into account the allowable voltage range in medium transmission lines ranges from 20 to 100 kv low tension cables are used for voltages up to 1kv in underground transmission line systems transmission lines are the connectors running between generating stations and distribution stations overview power transmission lines electric power transmission is the bulk movement of electrical energy from a generating site such as a power plant to an electrical substation and is different from the local wiring between high voltage substations and customers which is typically referred to as electric power distribution whenever power has to be transmitted over long distances dc transmission is the most economical solution compared to high voltage ac also from wikipedia hvdc transmission losses are quoted as less than 3 per 1 000 km which are 30 to 40 less than with ac lines at the same voltage levels the electric power can be transmitted either by using ac transmission system or dc transmission system each transmission system has its own advantages and disadvantages therefore to choose the right system for electric power transmission we need to compare the two systems ac dc transmission systems with 500 kv 330 kv and 220 kv ac lines and 500 kv dc lines were formed there were 6 regional grids and 3 independent provincial grids in the main land of china after the year 2000 with the rapid development of the national economy china s power industry went into a new developing period

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multi conductor cables with capacitance between conductors allow current to flow momentarily when the applied voltage changes such as with an ac waveform transmission lines are designed with specific impedances of 50 ohms 75 ohms etc which create a predictable current draw for certain frequency ranges regardless of cable length

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conductors on transmission lines carry 3 phase ac power with voltages exceeding 765 kv on the most modern ultra high voltage lines insulators prevent lines from shorting to each other or ground circuit breakers switches and reclosers provide protection and system control

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an example of an acsr aluminum cable steel reinforced transmission line the center strands are steel with aluminum outer strands image by clarkmills cc by sa 3 0 as one can imagine

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key differences between ac and dc transmission line the ac transmission line transmits the alternating current over a long distance whereas the dc transmission line is used for transmitting the dc over the long distance the ac transmission line uses three conductors for long power transmission

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engineers design transmission lines with a specific characteristic impedance to minimize these effects and ensure efficient power transmission this parameter measures the line s opposition to alternating current ac flow at a particular frequency

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skin effect is a phenomenon that occurs in transmission lines when an ac current flows through a conductor it causes an uneven distribution of current over the cross section of the conductor with more current flowing near the surface than near the core

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the allowable voltage range in medium transmission lines ranges from 20 to 100 kv low tension cables are used for voltages up to 1kv in underground transmission line systems transmission lines are the connectors running between generating stations and distribution stations

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overview power transmission lines electric power transmission is the bulk movement of electrical energy from a generating site such as a power plant to an electrical substation and is different from the local wiring between high voltage substations and customers which is typically referred to as electric power distribution

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whenever power has to be transmitted over long distances dc transmission is the most economical solution compared to high voltage ac also from wikipedia hvdc transmission losses are quoted as less than 3 per 1 000 km which are 30 to 40 less than with ac lines at the same voltage levels

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ac dc transmission systems with 500 kv 330 kv and 220 kv ac lines and 500 kv dc lines were formed there were 6 regional grids and 3 independent provincial grids in the main land of china after the year 2000 with the rapid development of the national economy china s power industry went into a new developing period

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