In the Name Of Allah More Mercy Gracious More merciful

Sudan University for Science & Technology

College of Graduate Studies

Transmission Line Design (Sag & Tension Calculation) in eastern Grid Project

تصميم خطوط نقل الطاقة الكهربية (حساب الشد والارتخاء) مشروع الشبكة الشرقية

A thesis Submitted in Partial Fulfillment for the requirement for the degree of M.Sc. of Science of Electrical Engineering (Power)

Prepared By :

Bahaeldeen Ali Abdelrahman Alamin

Supervisor :

Us. Khamees Arbeesh Saad Eldeen

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قال تعالى:

{قَالَ رَبِّ اشْرَحْ لِي صَدْرِي * وَيَسِّرْ لِي أَمْرِي * وَاحْلُلْ عُقْدَةً مِّن لِّسَانِي * يَفْقَهُوا قَوْلِي}

[illegible]

سورة طه الآيات (24-28)

Acknowledgement

I dedicate this study to

My :

Parents:,

Sisters , brothers,

Teachers ,

Who gave me A very good History,,,

To …. Who gave me faith that the future will be better ,,,

My Wife (Sara)

Who Gave The Live it's Meanings

My Child (Ahmed)

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Abstract

Electric power transmission line design is highly affected by the climatically conditions. Sudan climate is partially tropical & Subtropical considering that maximum & minimum temperature differences are between 5ºC to 50ºC night and day time respectively, form which high temperature is the main reason in transmission lines capacities.

The objective of this thesis is to (1) calculate the maximum sag and tension of transmission line between Gadarif and Shwak Substations under maximum temperature conditions. (2) To calculate the final and initial (sag & tension) in different condition of the winds.

The thesis also explains the climatic conditions and their effects on the line components design such as conductors and insulators.

It is also intended to choose the suitable design which enhances the line stability during transient and sub-transient conditions and the creep age distance after detecting the level of pollution.

Newton Raphson Method is used with the help of MATLAB software and parabolic equation is applied to solve the sag and tensions in different conditions using conductor technical particular specifications.

تجـــريد

تصميم خطوط نـ قل الطا قة الكهربائية يتأثر تأثيراً كبيراً بالظروف المناخ ية. يو صف م ناخ السودان بأنه مناخ استوائي او شبه استوائي باعتبار ان درجات الحرارة تتأرجح بين 5 درجات اثناء الليل ا لى 50 درجة أثناء ساعات النهار وتعـتبر الدرجة الـ قصوى للـحرارة **هي** العا مل الأساسي الذي يؤثر في تصميم سعة الخط النا قل.

الهدف الأساسي من هذه الدرا سة حـ ساب أ قصى شد وارتـ خاء في الـ خط الرا بط بـ ين محطتي الـ قضارف والشوك عند أ قصى وأدنى درجة حرارة. **وكذلك** حـ ساب (الشد والارتـ خاء عند احوال مختلفة ناتحة من تاثير الرياح).

هذه الدراسة توضح أيضاً تأثير الأحوال المناخية في اختيار مكونات خطوط نـ قل الطا قة الكهربائية (الموصلات والعوازل).

كذلك **تساعد** في اختيار التصميم اللازم لتحسين استـ قرارية الخط اثناء الـ حالات الـ عابرة والحالات العابرة بسرعة. **أيضاً** حساب مسافة الانحناءات في العوازل بعد تحديد مستوى التلوث البيئي.

تم استخدام طريـ قة نيوتن رافسون التكرارية في معادلة بارابولـ يك بلـ غة ماتلاب لحـ ساب الشد والارتخاء في أحوال مناخية مختلفة بعد اختيار المواصفات التـ قنية لموصلات خط النـ قل.

List Of Abbreviations

PLS	Power Line System
UV	Ultra Violet Radiation
ACSR	Aluminum Conductor Steel Reinforced
UTS	Ultimate Tensile Style
FOC	Factory of Safety
TM	Maximum Temperature (Design Operating Temperature)
TA	Ambient Temperature
MWT	Maximum Work Tension
OTM	Over turning Moment
BIL	Basic Insulation Level
ESDD	Equivalent Salt Deposit Density
NEC	National Electricity Corporation
SLiM	Sag Line Mitigator
OPGW	Optical Ground Wire
GSW	Ground Steel Wire

STANDARD

ANSI	=	**American National Standards Institute**
AS	=	**Australian Standard**
ASTM	=	**The American Society for Testing and Materials**
BS	=	**British Standard**
IEC	=	**International Electrotechnical Commission**
ISO	=	**International Standard Organisation**
JIS	=	**Japanese Industrial Standard**
NEMA	=	**National Electrical Manufacturers Association**

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