

بسم الله الرحمن الرحيم

قال : □□□□

(اللَّهُ نُورُ السَّمَاوَاتِ وَالْأَرْضِ مِثْلُ نُورِهِ كَمِشْكَاةٍ فِيهَا
مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ
دُرِّيُّ يُوقَدُ مِنْ شَجَرَةٍ مَبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا
غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ نُّورٌ
عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ
الْأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ)
صَدَقَ اللَّهُ الْعَظِيمُ

سورة النور الآية 35

Dedication

This work is dedicated to my family ... in their
help and support through the life journey
My friends ... for being always there, giving
without remembering, receiving without
forgetting

For those who come across our life at times
when our own light goes out ... all the deep
gratitude for them for lightening the flame back
within us.

Acknowledgement

Coming together is a beginning, keeping together is progress and working together is success. As I look back over the last few months, certainly there was a beginning, and thankfully there was also progress and yes-undeniably I have been successful!

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I am thankful too to all the temporary failures for being my stepping stones to greater experience.

Abstract

The main target and objective of this thesis is to avoid blackouts and to have a secure operating point with loadings of the transformers and transmission lines, below their limits to have a good margin for N-1 contingency analysis.

Contingency analysis and evaluation are the most important tasks for planning and secure operation of large power systems.

This thesis focuses on the contingency analysis of Sudanese National Grid (NGS) due to the rapid load growth and the transmission lines expanded.

A power system under normal operation may face contingencies such as line outages, generator outages, loss of transformers, and sudden change in the loads or faults. These may cause transmission line over loading and bus voltage limit violations.

For that reason Sudanese National Grid is simulated with base load (1700 MW). NEPLAN Program is used to study and analyze the contingency for the critical events which may occur. Major observations of dynamic behavior of the system are discussed.

Lastly, a conclusion and recommendation are made.

مستخلص

الهدف الرئيسي من هذه الدراسة تجنب ظاهرة الإضرار التام والحصول على تشغيل آمن بقدرة الإمكان في شبكة السودان القومية.

تحليل الحالات الطارئة التي تحدث في نظم القدرة الكهربائية من الأهمية بمكان للتخطيط والتشغيل الآمن لنظم القدرة الممتدة.

وتم في هذه الأطروحة دراسة الشبكة السودانية للحالات الطارئة الحدوث نسبة للزيادة السريعة في الأحمال والتوسع في خطوط النقل والتوليد. وهذه الحالات الطارئة تحدث أثناء التشغيل الطبيعي للشبكة مثل خروج خط أو خروج ماكينات التوليد أو خروج محولات القدرة أو التغيير المفاجئ في الحمولة بالزيادة أو النقصان بالإضافة للأعطال المفاجئة في نظم القدرة، وهذه الأسباب التي ذكرت أعلاه قد تتسبب في تحميل خطوط النقل أو المحولات مما يؤدي الى فصلها أو حدوث اضطراب في الجهد.

ولهذا فقد تم محاكاة الشبكة السودانية باستخدام برنامج NEPLAN على اعتبار الحمولة الأساسية للشبكة (1700 ميغاواط) لدراسة الحالات الطارئة المحتملة الحدوث، ومناقشة هذه الحالات من خلال مراقبة النتائج التي حصلنا عليها لتطوير وتحسين الشبكة السودانية.

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List of Abbreviation

Abbreviation	Declaration
ANN	Artificial neural network
ATC	Available transfer capability.
D	Dangerous
DCOPF	Direct current optimal power flow
DD	Index definitely dangerous
EMS	Energy management system
FACTS	Flexible AC transmission system
FSS	First swing respectively stable
FSU	First swing respectively stable.
GSF	Generation shift factors
HOPS	Horizontally operated power system.
LODF	Line outage distribution factors
LP	Linear program
MIP	Mixed integer programming
NGS	National grid of Sudan or Sudanese grid.
NS	Non-sever
N-X	N the number of element, number of lost element
PD	Potentially dangerous
PI	Performance index
PS	Power system
RCI	Ranking based on reactive compensations
SCADA	Supervisory control and data acquisition.
STATCOM	Static compensation
SVC	Static VAR compensation