

## الآية الكريمة

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى: اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ (1) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ (2) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ

(3) الَّذِي عَلَّمَ بِالْقَلَمِ (4) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ (5)

صدق الله العظيم

سورة العلق

## **DEDICATION**

To our parents.....

The reason of what we become today.

Thanks for your great support and

Continuous care.

To our friends and colleagues.....

Whom are always with us and support us to go forward.

## **ACKNOWLEDGEMENT**

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History of all great work is to witness that no great work was ever done without either the active or passive support a person's surrounding and one's close quarters. Thus it's not hard to conclude how active assistance from seniors.

## **ABSTRACT**

Steady state power system insecurity such as transmission lines being overloaded causes transmission elements cascade outages which may lead to complete blackout. The power system operator must know the system state at any instant. The contingency analysis is used to predict which contingencies make system violations and rank the contingencies according to their relative severity. Contingency Analysis is useful both in the network design stages and for programmed maintenance or network expansion works to detect network weakness. The weaknesses can be strengthened by transmission capacity increase, transformers rating increase besides circuit breakers ratings increase. This work outlines have been carried out for the simulation of generator outages and transmission line and transformer outages so as to carry out a full AC load flow based contingency analysis and ranking. The method has been applied to Sudanese National Grid and gives good results in determining the network weakness.

## المستخلص

عدم الأمان في منظومة القدرة الكهربائية في الحالة المستقرة مثل: التحميل الزائد في خطوط النقل قد يسبب الخروج المتتابع لبقية عناصر القدرة الكهربائية مما ينتج عنه الظلام التام . على مشغل نظم القدرة أن يكون ملماً بحالة النظام في أي لحظة. تحليل الطوارئ (الأحداث) يستخدم للتعرف على أسباب هذه الأحداث سوف يؤدي إلى الانحراف عن القيم الطبيعية وترتيبها بناءً على خطورتها , و هذا التحليل مفيد جداً في مراحل التصميم و الصيانة المبرمجة (الدورية) وعمليات التوسعة في الشبكة وتحديد العناصر الضعيفة بغرض المعالجة (زيادة سعة خطوط النقل و زيادة مقننات المحولات مع زيادة في مقننات أجهزة الحماية). و في هذه الدراسة تم عمل محاكاة لخروج مولد و خط نقل و محول باستخدام أحد تطبيقات الحاسوب لعمل تحليل لانسياب الحمولة بناءً على تحليل الطوارئ و ترتيبها. تم تطبيق هذه الطريقة على الشبكة القومية السودانية و أعطت نتائج مرضية لتحديد العناصر الضعيفة في الشبكة.

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## LIST OF ABBREVIATIONS

GOSF	Generation Outage Sensitivity Factor
LOSF	Line Outage Sensitivity Factor
APLPI	Active Power Loading Performance Index
<i>PI</i>	The Performance Index

## LIST OF SYMPOLES

$Z$	Impedance
$Y$	Admittance
$I$	Bus Current
$V$	Bus Voltage
$P$	Active Power
$Q$	Reactive Power
$\delta$	Power Angle
$J$	Jacobean Matrix
$\alpha$	The Generation Outage Sensitivity Factor
$\Delta f$	Change In Power Flow In Specified Line
$\Delta P$	Change In Generation At Specified Bus
$M$	Total Number Of Generators In The System
$\gamma_{gk}$	Proportionality Factor For Generation 'g' To Pick Up Generation when Unit 'k' Fails
$\beta$	Line Outage Distribution Factor
$W_p$	The Weight Factor Of Active Power Flow On Specific Line
$NL$	Number Of Transmission Lines
$M$	Positive Integer