الآية

﴿وَيَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُم مِّن الْعِلْمِ إِلاَّ قَلِيلاً﴾

الإسراء (85)

DEDICATION

TO

My Dearest Parents who are the part of my soul and whose love, affection and confidence enabled me to achieve this goal.

TO

My Friends who have encouraged me to complete this work.

To anyone who have supported me with good ideas throughout the project.

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*To the **Almighty God** who have granted me all these graces to fulfill this work and who blessed and supported me by this power in all my life. Without this guidance I would have never reached this position where I am writing this page. To him I extend my heartfelt thanks.*

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ABSTRACT

Due to the ever increasing demand for power, economic and environmental constraints that limit the expansion and restructuring transmission networks, the transmission lines are prone to be operated under heavily stress conditions, and power systems to operate near critical limits.

This thesis investigates different scenarios to improve the power transfer capability of (Atbara-Portsudan) transmission line as one of the national grid problems. This line was selected depending on line indices such as Fast Voltage Stability Index (FVSI), Line Stability Index (L_{mn}). Simulation was carried out using NEPLAN software, based on data given from National Load Dispatch Center (NLDC) in Sudan. National grid was studied in peak and off-peak cases, to clearly represent the problem. All the results presented in comparison form to find the best scenario. Power transfer capability of (Atbara-Portsudan) could be enhancing up to 150% of existing load by using TCSC beside SVC installed in Portsudan. However the ultimate solution is double-circuit transmission line beside local generation station.

المستخلص

أصبح تشغيل نظم القدرة الكهربائية أكثر صعوبة مع الزيادة المستمرة للطلب على الطاقة الكهربائية ، والقيود البيئية والإقتصادية التي تحد من التوسع في إنشاء أو إعادة هيكلة شبكة نقل الكهرباء ، مما أجبر شبكة نقل الكهرباء للعمل تحت ظروف واجهادات كبيرة ، و أن تعمل بالقرب من الحدود الحرجة لها.

هذه الأطروحة عرضت سيناريوهات مختلفة لزيادة القدرة المنقولة خلال خط النقل (عطبرة – بورتسودان) باعتباره واحد من مشاكل الشبكة القومية. وقد تم اختيار هذا الخط إعتماداً على مؤشرات الخطوط مثل مؤشر الاستقرار السريع للجهد (FVSI) و مؤشر استقرارية الخطوط (L_{mn}). وقد أجريت المحاكاة باستخدام برنامج NEPLAN ، إستناداً إلى البيانات الواردة من مركز التحكم القومي في السودان. وتمت دراسة الشبكة القومية في حالات الذروة العليا والدنيا، لتمثيل المشكلة بوضوح. كل النتائج المتحصل عليها وضعت في جداول مقارنة لإيجاد أفضل سيناريو للحل .

لزيادة القدرة المنقولة خلال خط النقل (عطبرة – بورتسودان) يمكن أن تعزز حتى 150% من الحمولة الحالية باستخدام TCSC بجانب SVC الموجود في بورتسودان. ولكن الحل النهائي يكمن في استخدام خط مزدوج بجانب محطة توليد محلية.

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ABBREVIATIONS

AC	Alternating current.
DC	Direct current.
FACTs	Flexible AC Transmission Systems.
SVC	Static VAR compensators.
TCSC	Thyristor Control Series Compensator
STATCOM	Static Synchronous Compensator.
SSSC	Static Synchronous Series Compensator.
UPFC	Unified Power Flow Controller.
IPFC	Interline Power Flow Controller.
TCR	Thyristor Controlled Reactor.
FC	Fixed Capacitor.
V_S	Sending end voltage.
V_R	Receiving end voltage.
FVSI	Fast Voltage Stability Index
L_{mn}	Line stability index.
B_{TSC}	Susceptance of thyristor switched capacitor.
B_{TCR}	Susceptance of thyristor controlled reactor.
X_{TCSC}	Total TCSC reactance.
ATB	Atbara
POR	Portsudan
NLDC	National Load Dispatch Centre