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Real time monitoring of power cables by fibre optic technologies tests, applications and outlook

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Abstract : The change in operating conditions of HV underground cable links has led many utilities to consider on-line and/or off-line temperature monitoring via optical fibres. This paper describes the test program and preliminary results obtained on a 400 kV test installation, including various methods of cable installation, different kinds of temperature sensors and the implementation of a real time monitoring system. Simulation of different operating scenarios (steady-state and transient overloading) was performed and the resulting ampacities were evaluated.
The paper discusses the outlook for the application of such monitoring technologies.

Keywords : Distributed temperature sensing, dynamic feeder rating.

Résumé : L'évolution des conditions d'exploitation des liaisons souterraines HT a conduit de nombreux exploitants à envisager le monitoring en température des liaisons. Cet article décrit le programme d'essais mis en œuvre sur une boucle d'essais 400kV incluant sur son parcours différents modes de pose, différents types de capteurs de température ainsi qu'un système de monitoring spécifique. La simulation de différents modes de fonctionnement (régime permanent et régime de surcharge transitoire) a été réalisée et les intensités résultantes évaluées.

Cet article discute des perspectives d'application de ce type de monitoring.

Mots clés : Mesure de température répartie, contrôle dynamique de capacité de transport.

1. Introduction

During the lifetime of a buried power cable, typically 40 years, its thermal environment can evolve due to modifications of the network configuration and changes in the local surroundings. This phenomenon is particularly sensitive and difficult to control in urban areas.

The dimensioning of an extruded cable link is governed by the maximum allowable temperature on the cable conductor. If this temperature is exceeded, the lifetime and reliability of the cable circuit can be reduced. This can lead to unexpected premature breakdowns.

Moreover, economic factors are driving utilities to use their cable circuits to achieve maximum allowable ampacity rating, thus using up previously allowed safety margins.

Real time temperature monitoring tools are now available to users, allowing them to maintain network reliability even though the network is being operated harder.

Thanks to the development of distributed temperature measurement using optical fibres, it is possible :

- to monitor the temperatures reached along the entire cable route.
- to compute the maximum acceptable ampacity taking into account the simultaneously measured thermal conditions.