JICABLE '99

B8.1

A new method for the measurement of power cables AC resistance

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Résumé :
La résistance en courant alternatif des câbles souterrains conditionne directement la capacité de transport des liaisons. Elle est donc un axe d'optimisation des liaisons souterraines, en particulier pour celles utilisant des câbles de forte section. Un banc de mesure de la résistance en courant alternatif des âmes des câbles a été développé. Les premiers résultats montrent une grande influence de la construction sur la résistance à section donnée.

Abstract :
The alternating current resistance of underground cables governs directly the ampacity of underground links. It is thus an optimisation topic of underground links, especially for those with large cross section conductors. A test bench for the measurement of cables conductors AC resistance has been developed. The first results show a large influence of the conductor structure on the resistance for a given cross section.

1-Introduction

The ampacity of any underground cable link is directly connected with the conductor AC resistance. It is therefore an optimisation topic of underground links, especially for those with large cross section conductors. Indeed, it is interesting to build a conductor structure that yields the smallest AC resistance. That is to say a conductor in which the skin effect is as reduced as possible, the bottom value being the conductor DC resistance : $R_{DC} = \frac{\rho}{S}$.

Figure 1 shows the increase of ampacity of a segmental conductor compared to that of a solid conductor. The ratio of the ampacities of a segmented conductor and of a solid conductor, for copper cross sections ranging from 630 mm² to 2000 mm², reaches 1.2 : this proves the influence of the skin effect on the ampacity . The segmented conductor resistance is calculated with the IEC 287 formulae [1].

The electromagnetic proximity effect between phases is not taken into account.

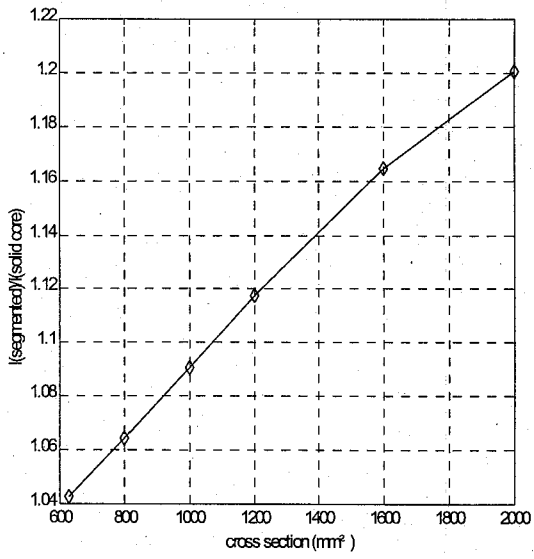

Figure 1 : ampacity computed with a segmented conductor, divided by the ampacity computed with a solid conductor, versus cross section.

It is interesting to study the ratio R_{AC}/R_{DC}, which will indicate how efficient a conductor design is. Figure 2 shows the ratio R_{AC}/R_{DC} of a solid conductor and of a segmented conductor, for copper cross sections ranging from 630 mm² to 2000 mm². The segmented conductor resistance is calculated with the IEC 287 formulae [1]. Again, the proximity effect is not taken into account.