

电力系统

TCSC阻抗双解现象的机理研究

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摘要

TCSC是靠调整触发角来获得需要的命令阻抗,因此命令阻抗与触发角的关系尤为重要,以往对TCSC阻抗双解研究局限于讨论电抗器品质因数的影响,该文讨论了考虑晶闸管导通特性和电抗器支路品质因数影响时TCSC的阻抗特性,文中通过相量图分析发现,即使在品质因数不变的情况下,随着晶闸管导通电流的增大,电容电压过零点与线路电流过零点之间的相位差也会逐渐减小,引起晶闸管实际导通幅度和宽度的减小;指出了造成TCSC双解现象的根本原因是晶闸管的导通受阻,其受阻程度由电抗器支路的电流和等效品质因数2个因素决定:线路电流同步方式下晶闸管导通电流的幅度和宽度均受阻;而电容电压同步下,晶闸管导通电流只有幅度受阻,因此阻抗双解现象在线路电流同步方式下更容易出现。数字仿真和动模实验结果分别验证了阻抗双解现象的存在。

关键词 [电力系统](#) [可控串联补偿\(TCSC\)](#) [阻抗双解](#) [相量图](#) [品质因数](#) [晶闸管导通特性](#)

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The Mechanism Research on Dual Impedance Solutions of Thyristor Controlled Series Compensation

Abstract

The desired impedance of a TCSC is usually obtained by adjusting the firing angle and it is of great importance to make clear the relationship between the two quantities. Most researches about TCSC dual solution phenomenon focus on the influence of reactor quality factor. The impedance characteristics of a TCSC are studied in the paper, considering the influence of the thyristor conduction characteristics and the equivalent resistance in the reactor branch. Analysis of the phase diagram shows that with thyristor conduction current increasing while reactor quality factor remaining constant, the phase difference decreases between the crossing-zero points of capacitor voltage and line current, which incurs the decrease of thyristor conduction amplitude and width. Further, the thyristor conduction block is pointed out to be the fundamental mechanism of TCSC dual solution phenomenon. Reactor branch current and equivalent quality factor determine the degree of thyristor conduction block. Both amplitude and width of the thyristor conduction current are blocked in the mode synchronized by line current while only amplitude of the thyristor conduction current is blocked synchronized by capacitor voltage. This is why impedance dual solution phenomenon is susceptible to occur in the mode of line current synchronization. The existence of the dual solution phenomenon is demonstrated by both the digital simulation and dynamical emulation experiment.

Key words [power system](#) [thyristor controlled series compensation \(TCSC\)](#) [dual impedance solutions](#) [phase diagram](#) [quality factor](#) [thyristor conduction characteristic](#)

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