电力系统仿真及分析计算

直流输电系统交流侧谐波电流计算的改进时域分段法

薛英林[1]，徐政[1]，黄莹[2]，黎小林[2]

1. 浙江大学电气工程学院，2. 南方电网研究技术中心

摘要： 谐波电流计算是直流输电系统滤波器设计的首要环节。提出一种基于时域分段法的改进快速算法，可以统一求解交流侧特征和非特征谐波电流。根据直流输电系统的特点假设直流输电线路入口处的谐波电压为零，使整流侧和逆变侧的谐波电流计算相互解耦，避免计算过程中对直流线路的建模。精确计算对非特征谐波有重要影响的换相角，保证换相区间和非换相区间的精确划分。计算过程中充分考虑了交流侧负序基波电压、背景谐波电压、触发角不对称、换流变压器三相参数不对称等各种非理想因素的影响，同时计及了直流侧纹波对交流侧谐波电流的影响。通过与PSCAD/ EMTDC时域仿真结果对比，证明所提算法速度快、精度高，满足直流工程滤波器设计对谐波电流计算的要求。

关键词： 时域分段　谐波电流　背景谐波　换相角　PSCAD/EMTDC

Improved Time Domain Piecewise Calculating Method for AC Side Harmonic Current of HVDC Systems

XUE Yinglin[1], XU Zheng[1], HUANG Ying[2], LI Xiaolin[2]

1. Department of Electric Engineering, Zhejiang University
2. China Southern Grid Research Center

Abstract: Harmonic current calculation is the critical part in the design and configuration of AC filters in HVDC projects. A modified time domain piecewise algorithm was proposed, which can calculate both non-characteristic and characteristic harmonic currents in the AC side simultaneously. At first, based on the characteristics of HVDC systems, the harmonic voltages on the entrance of the DC line were assumed to be zero. This assumption decouples the harmonic current calculation process of the rectifier side and the inverter side, and avoids the modeling of the DC line in the harmonic current calculation. Secondly, the overlap angles were calculated accurately by considering the usual non-ideal factors, including the negative sequence fundamental voltage and the background harmonic voltages on the AC side, the unsymmetrical firing angles and the imbalance of converting transformer impedances. This ensures an exact partition of the commutation interval and the non-commutation interval, which has an important influence on the non-characteristic harmonic computation. The effect of the DC current ripple was also taken into account in the calculation of the AC side harmonic current. The validity of the proposed method was demonstrated by comparison with the simulation results of PSCAD/EMTDC. It shows the proposed method is fast and accurate, and can meet the requirement of HVDC filter design for practical projects.

Keywords: time domain piecewise　harmonic current　background harmonic　overlap angle　PSCAD/EMTDC

通讯作者: 薛英林

作者简介：

作者Email: xueyinglin@zju.edu.cn

参考文献：

本刊中的类似文章

1. 薛花 姜建国.并联型有源滤波器的自适应无源性控制方法研究[J]. 中国电机工程学报, 2007,27(25): 114-118

2. 帅智康 罗安 祝文姬 范瑞祥 唐杰.注入式混合有源电力滤波器的复合控制[J]. 中国电机工程学报, 2008,28(15): 84-91

3. 帅智康 罗安 祝文姬 刘定国 李峰.并联型有源电力滤波器容量和最优安装位置的选择方法[J]. 中国电机工程学报, 2009,29(13): 92-98

4. 赵伟 罗安.新型并联混合有源滤波器中直流侧电压抬升问题及其解决措施[J]. 中国电机工程学报, 2009,29(9): 8-15

5. 高吉磊 张雅静 林飞 郑琼林.单相PWM整流器谐波电流抑制算法研究[J]. 中国电机工程学报, 2010,30(21): 32-39

6. 牟宪民 刘凤春 王建赜 纪延超.EU正交铁心可控电抗器[J]. 中国电机工程学报, 2009,29(24): 122-126

7. 张树全 戴珂 谢斌 余蜜 康勇.多同步旋转坐标系下指定次谐波电流控制[J]. 中国电机工程学报, 2010,30(3): 55-62

8. 王学华 阮新波 刘尚伟.抑制电网背景谐波影响的并网逆变器控制策略[J]. 中国电机工程学报, 2011,31(6): 7-14

9. 徐韬 翁华 徐政 黄莹 黎小林.高压直流输电非解耦线路模型改进算法[J]. 中国电机工程学报, 2011,31(7): 71-76