电网技术 2010, 34(7) 206-210 DOI: ISSN: 1000-3673 CN: 11-2410/TM

高电压技术

灰色关联度分析在变压器油色谱峰辨识中的应用

曹建[1],范竞敏[1],安晨光[2]

1．中南大学 物理科学与技术学院，湖南省 长沙市 410083；2．北京华电云通电力技术有限公司，北京市 丰台区 100071

摘要：

为弥补传统色谱峰辨识算法存在的缺陷，将灰色关联度技术应用到变压器油色谱峰辨识领域。以色谱学塔板理论为基础，先根据大量的色谱实验数据拟合一个匹配的高斯数据序列，然后将高斯数据序列沿着色谱数据滑动，滑动过程中求高斯窗口与相应色谱数据的灰色B型关联度，关联度大于设定阈值的数据段存在色谱峰时，该数据段色谱峰的位置对应滑到该处的高斯窗口的峰位。试验结果表明：该算法能非常准确地辨识色谱峰，对噪声、色谱峰宽变化不敏感，且与色谱峰的保留时间无关，具有非常好的抗干扰性和自适应性。

关键词：

Application of Grey Correlation Analysis in Chromatograph Peak Identification of Transformer Oil

CAO Jian1, FAN Jing-min1, AN Chen-guang2

1. School of Physics Science and Technology, Central South University, Changsha 410083, Hunan Province, China; 2. Beijing Huadian Yuntong Power Technical Co., Ltd., Fengtai District, Beijing 100071, China

Abstract:

To remedy the defects in conventional chromatographic peak identification algorithms, the grey correlation analysis is applied in chromatographic peak identification of transmission oil. According to the plate theory in gas chromatography, firstly based on plenty of chromatographic experimental data a Gaussian data sequence, which matches with the experimental data, is fitted; then the Gaussian data sequence is slide along the chromatographic data and during the sliding the grey B-type correlation degree between Gaussian window and corresponding chromatographic data is calculated, in the data segment where the correlation coefficient is greater than the predetermined threshold value the chromatographic peak exists and the position of the chromatographic peak in this data segment corresponds to the peak position of Gaussian window that moves to the place. Experimental results show that the proposed algorithm can identify chromatographic peaks accurately and is insensitive to both noise and change of the width of chromatographic peak, in addition, it is also independent of retention time of chromatographic peak, so it possesses excellent noise immunity and adaptability.

Keywords:

收稿日期 2009-03-27 **修回日期** 2009-06-26 **网络版发布日期** 2010-07-13

DOI:

基金项目:

国家自然科学基金资助项目(50277039)。

通讯作者: 曹建

作者简介:

作者Email: caojian1955@126.com;tfirst@163.com

参考文献：

[1] 沈智健，卢继平，赵渊，等．变压器比率差动保护判据的可靠性评估模型[J]．电网技术，2008，32(7)：14-18． Shen Zhijian，Lu Jiping，Zhao Yuan，et al．A reliability evaluation model of Percentage differential protection criteria for transformers [J]．Power System Technology，2008，32(7)：14-18(in Chinese)． [2] 安源，刘家军．基于小波理论和多分辨分析的变压器励磁涌流识别方法[J]．电网技术，2007，31(17)：21-25． An Yuan，Liu Jiajun．A method to identify inrush current of transformer based on

wavelet theory and multiresolution analysis [J]. Power System Technology，2007，31(17)：21-25(in Chinese). [3] 孙元章，程林，刘海涛. 基于实时运行状态的电力系统运行可靠性评估[J]. 电网技术，2005，29(15)：6-12. Sun Yuanzhang，Cheng Lin，Liu Haitao. Power system operating reliability evaluation based on real-time operating state[J]. Power System Technology，2005，29(15)：6-12(in Chinese). [4] 唐杰明，刘俊勇，杨可，等. 基于灰色模型和最小二乘支持向量机的电力短期负荷组合预测[J]. 电网技术，2009，33(3)：63-68. Tang Jieming，Liu Junyong，Yang Ke，et al. Short-Term load combination forecasting by grey model and least square support vector machine[J]. Power System Technology，2009，33(3)：63-68(in Chinese). [5] 王磊，孔冬. 变压器分接开关油中溶解气体的在线监测[J]. 电网技术，2008，32(15)：99-102. Wang Lei，Kong Dong. On-line monitoring of oil-dissolved gas for transformer tap changing switch [J]. Power System Technology，2008，31(15)：99-102(in Chinese). [6] Lin C H，Wu C H，Huang P Z. Grey clustering analysis for incipient fault diagnosis in oil-immersed transformers[J]. Expert Systems with Applications，2008，16(10)：1-9. [7] Chen A P，Lin C C. Fuzzy approaches for fault diagnosis of transformers[J]. Fuzzy Sets and Systems，2001，118(1)：139-151. [8] 刘震，邹汉法，叶明亮，等. 温度和缓冲溶液对胶束电动毛细管色谱的迁移时间窗口的影响[J]. 色谱，1999，17(2)：147-152. Liu Zhen，Zou Hanfa，Ye Mingliang，et al. Effects of temperature and buffer on migration time window of micellar electrokinetic capillary chromatography[J]. Chinese Journal of Chromatograph，1999，17(2)：147-152(in Chinese). [9] 王崇杰，崔玉影. 色谱数据中单高斯峰的数值处理方法[J]. 分析仪器，1997(4)：28-32. Wang Chongjie，Cui Yuying. Numerical value calculation methods for processing uni-gauss peaks in chromatographic data[J]. Analytical Instrumentation，1997(4)：28-32(in Chinese). [10] 李一波，黄小原，沙明. 基于导数直方图和神经网络的色谱基线提取算法分析仪器[J]. 分析实验室，2001，20(3)：4-7. Li Yibo，Huang Xiaoyuan，Sha Ming. Extraction of baseline of chromatography based on histogram of first derivative HPLC and neural networks[J]. Chinese Journal of Analysis Laboratory，2001，20(3)：4-7(in Chinese). [11] 孙汉文，闫正，刘丽平，等. 导数测量技术在气相色谱信号处理中的应用[J]. 色谱，1999，17(2)：175-177. Sun Hanwen，Yan Zheng，Liu Liping，et al. Application of derivative of technique in the signal processing of gas chromatography [J]. Chinese Journal of Chromatograph，1999，17(2)：175-177(in Chinese). [12] 缪华键，胡上序. 一阶和二阶导数相综合的色谱峰检测法[J]. 分析化学，1994，22(3)：247-250. Miao Huajian，Hu Shangxu. Chromatographic peak detecting algorithm combing the first and second derivatives[J]. Chinese Journal of Analytical Chemistry，1994，22(3)：247-250(in Chinese). [13] 胡劲松，周方洁，鲍吉龙，等. 基于模糊隶属度函数的变压器色谱峰定性算法[J]. 电力系统自动化，2005，29(18)：70-72. Hu Jingsong，Zhou Fangjie，Bao Jilong，et al. Qualitative algorithm for fuzzy membership function based transformer chromatogram components[J]. Automation of Electric Power Systems，2005，29(18)：70-72(in Chinese). [14] 袁鹏，张铭光，袁敏，等. 模糊聚类分析法在郁金裂解色谱测定指纹图谱中的应用研究[J]. 计算机与应用化学，2005，22(3)：201-205. Yuan Peng，Zhang Mingguang，Yuan Min，et al. Application of fuzzy cluster analysis in determining fingerprint spectrum of curcuma aromatic salib by pyrolysis gas chromatography[J]. Computers and Applied Chemistry，2005，22(3)：201-205(in Chinese). [15] 胡劲松，鲍吉龙，周方洁，等. 基于模式匹配的变压器色谱峰定性算法[J]. 电力系统自动化，2005，29(21)：85-87. Hu Jingsong，Bao Jilong，Zhou Fangjie，et al. Mode matching based transformer chromatogram peaks identification algorithm [J]. Automation of Electric Power Systems，2005，29(21)：85-87(in Chinese). [16] 刘国诠，余兆楼. 色谱柱技术[M]. 北京：化学工业出版社，2005：2-5. [17] 达世禄. 色谱学导论[M]. 武汉：武汉大学出版社，1999：59-67. [18] 刘思峰，党耀国，方志耕. 灰色系统理论及其应用[M]. 北京：科学出版社，2004：75-76. [19] 安晨光，曹建，丁家峰. 基于SOFC的变压器油中溶解气体在线监测仪的设计[J]. 电力系统自动化，2008，32(14)：82-85. An Chenguang，Cao Jian，Ding Jiafeng. A quantitative online detector of gas dissolved in transformer oil based on SOFC[J]. Automation of Electric Power Systems，2008，32(14)：82-85(in Chinese).

本刊中的类似文章
