Dynamic Alarm Prediction for Critical Alarms Using a Probabilistic Model

Jianfeng Zhu, Chunli Wang, Chuankun Li, Xinjiang Gao, Jinsong Zhao

PII: S1004-9541(16)30304-4
DOI: doi: 10.1016/j.cjche.2016.04.017
Reference: CJCHE 519

To appear in:

Please cite this article as: Jianfeng Zhu, Chunli Wang, Chuankun Li, Xinjiang Gao, Jinsong Zhao, Dynamic Alarm Prediction for Critical Alarms Using a Probabilistic Model, (2016), doi: 10.1016/j.cjche.2016.04.017

Dynamic Alarm Prediction for Critical Alarms Using a Probabilistic Model

Jianfeng Zhu[1], Chunli Wang[1], Chuankun Li[1], Xinjiang Gao[1], Jinsong Zhao[2]

([1]*Sinopec Research Institute of Safety Engineering, Qingdao, Shandong 266071, China;* [2]*State Key Laboratory of Chemical Engineering, Department of Chemical Engineering, Tsinghua University, Beijing 100084, China*)

Abstract:

Alarm systems play important roles for the safe and efficient operation of modern industrial plants. Critical alarms are configured with a higher priority and are safety related among many other alarms. If critical alarms can be predicted in advance, the operator will have more time to prevent them from happening. In this paper, we present a dynamic alarm prediction algorithm, which is a probabilistic model that utilizes alarm data from distributed control system, to calculate the occurrence probability of critical alarms. It accounts for the local interdependences among the alarms using the n-gram model, which occur because of the nonlinear relationships between variables. Finally, the dynamic alarm prediction algorithm is applied to an industrial case study.

Keywords: Dynamic alarm prediction; alarm management; the n-gram model; alarm sequence

1. Introduction

Alarm systems play a significant role in the safe management of large industrial plants. Typically, alarm systems are installed in distributed control systems (DCSs). However, with the advance of hardware and software, it is much easier to measure almost every process variable so that more alarms are configured to monitor the process, though some alarms are not useful to operators. This makes the alarm system inefficient, which is a significant cause of industrial incidents and serious accidents. For example, the explosion and fires at the Milford Haven Refinery in the UK, which caused £48 million of plant damage plus major production loss, could be prevented by the operating staff. They failed to do this partly because they faced a continuous barrage of alarms for a 5 h period leading to the accident [1].

Received date: 2006-00-00.

Corresponding author: Jianfeng Zhu. **E-mail:** zhujf.qday@sinopec.com

Foundation item: The National High Technology Research and Development Program (2013AA040701)