

# Computer-Aided Fault-Tree Synthesis for Quantitative Risk Assessments

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## **ABSTRACT**

Fault tree analysis (FTA) has been used in the chemical process industry (CPI) for systematic safety and reliability analysis during the past decades. Because manual construction of fault trees can be extremely time consuming and vulnerable to human error, automation of fault tree synthesis is highly desirable. However, no entirely satisfactory algorithm has been published for fault tree synthesis, especially when control loops are encountered.

A new methodology to construct fault trees automatically is proposed in this paper. System block diagram and cause and effect unit models are employed to model chemical processes. An example is embedded in the description of the methodology for better understanding. Analysis shows that the fault tree generated here is equivalent to the published result.

This algorithm works directly from the system block diagram, thus avoids the tedious work of drawing digraphs, transition tables, *etc.* Control loops are considered and treated by special cause and effect unit models – logical combinations of the unit models of their constituent components. Multiple or complex control loops can be easily taken into account by providing their corresponding cause and effect unit models. In particular, the fault tree construction algorithm presented here is based on a component-by-component basis instead of a loop-by-loop or node-by-node basis. The developed tree structure is much more concise and easier to read.