

# The Investigation of NPP Control and Monitoring Functional Analysis Applied to Functional Displays' Implementation

YAN Jin, QIAN Lihu

State Nuclear Power Automation System Engineering Company, Engineering Center, Shanghai, China

## Introduction

The performance, quality, innovation and also other features of the product has been determined by whether function analysis as the major activity of conceptual design section has been executed properly. The function model employed in analysis process has carried on description and expression to the function language and function behavior of the product, which has played important role in the product design and analysis.

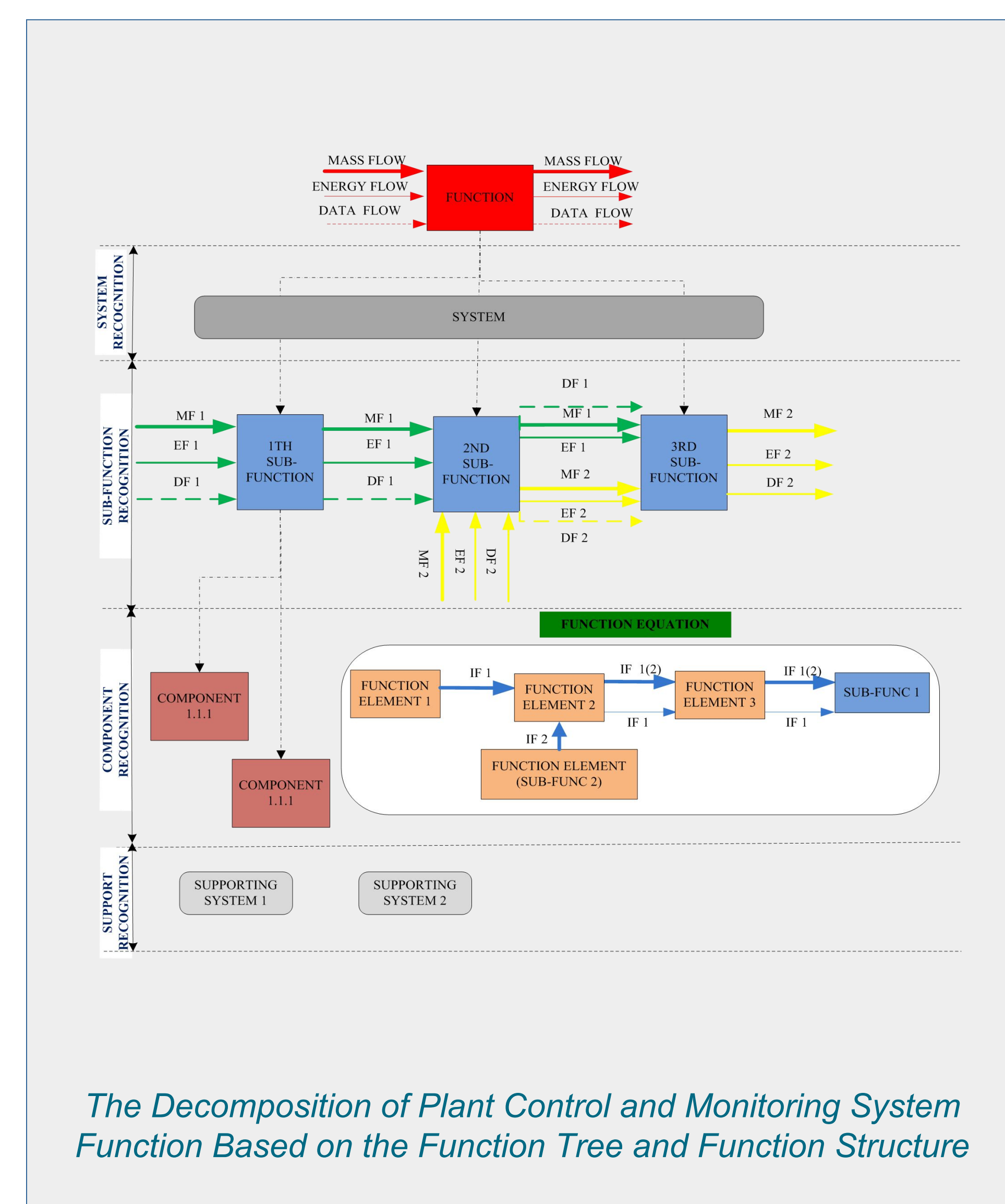
The functions of Plant Control and Monitoring System of NPP have to be highly integrated in order to improve the response capability. The design and implementation of PLS including system architecture, control logic, display, I/O allocation and so on has been ensured properly, so long as it has been performed that the decomposition and allocation of functions by adopting the proper function model.

## Purpose

In order to satisfy the design requirements of PLS control and monitoring functions, it has been considered as the vital process to select the suitable function analysis model for PLS. therefore, in this paper, both the advantages and disadvantages of several common functions, such as Function Analysis System Technique, Function Tree Model, Function Structure Model, have been discussed first; second, it has been recommend to employed in the control and monitoring function design of CAP1400 demonstration Project that is the innovation of function analysis based on the combination of function tree model and function structure model; RCS Inventory Control Function has been selected as an example to explain how to acquire the analysis results based on this new model.

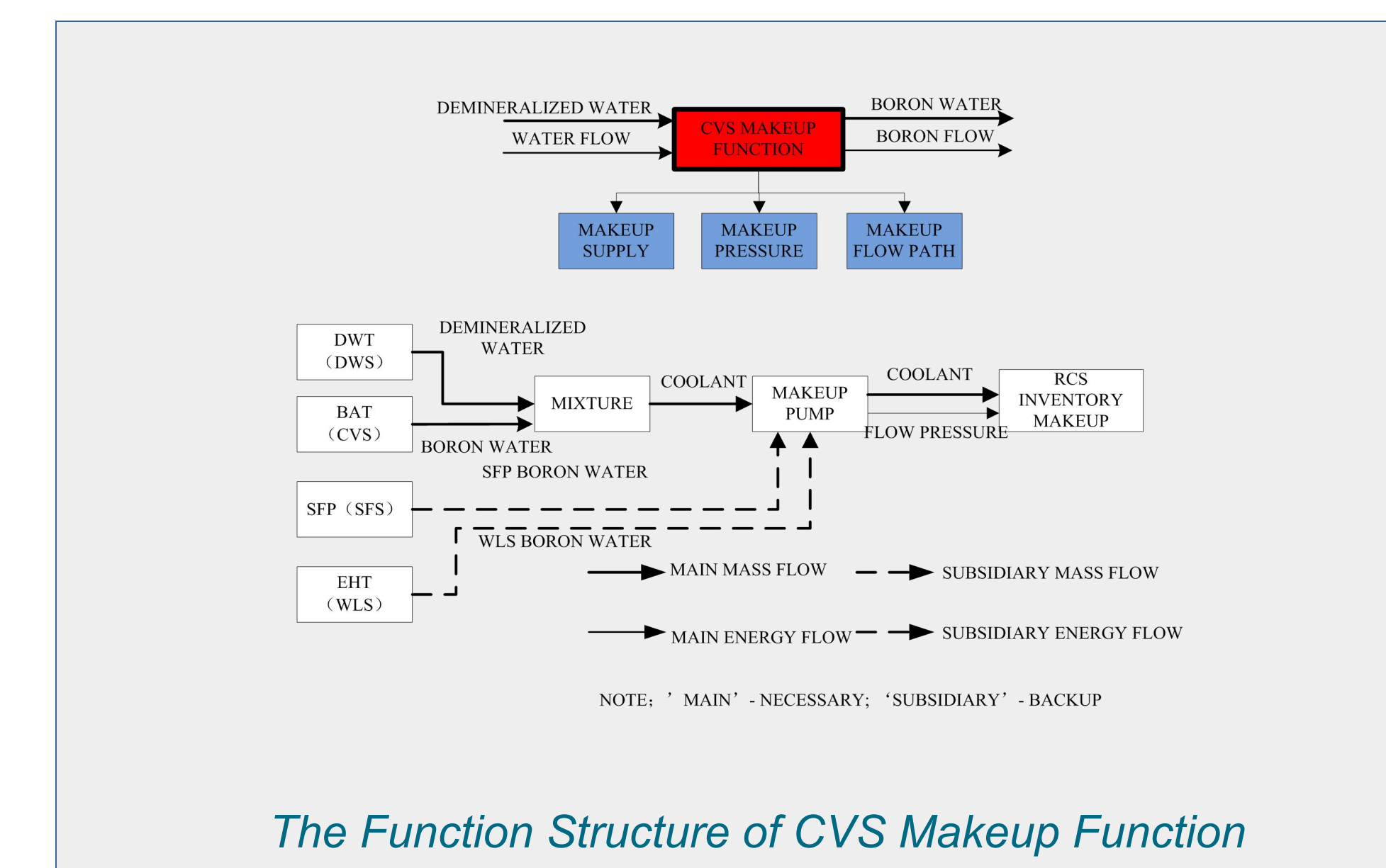
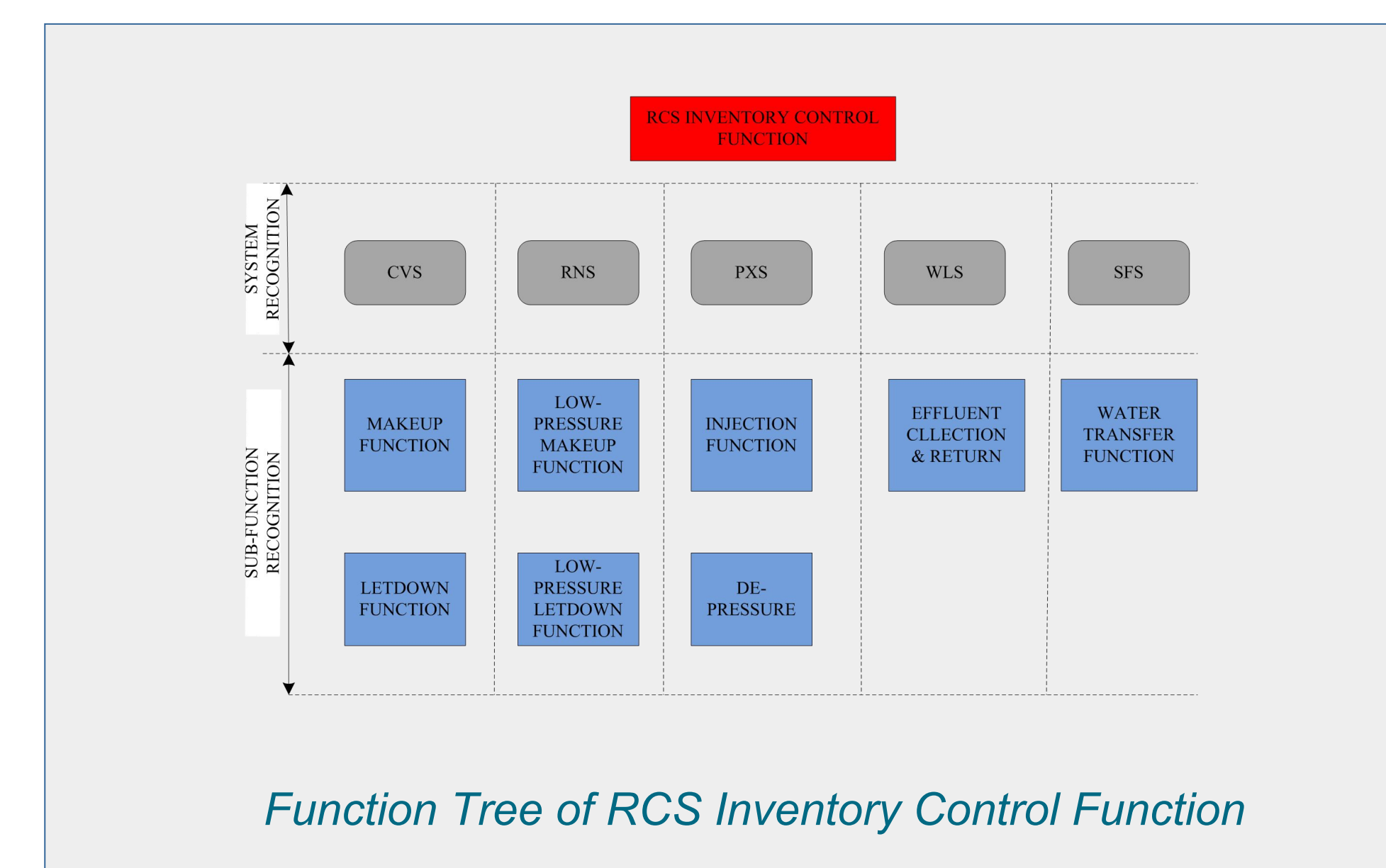
## Innovative Method

- Regarding to the complexity of NPP Plant Control and Monitoring System function, an innovative function analysis method which is the combination of FAST method and FS method is recommended.
- The establishment of function tree has been applied to the implementation of function - system - subfunction - component decomposition, thus the Hierarchy structure has been represented by function tree.
- The decomposition of sub-function to component has depended on the function equation.
- The relations of sub-functions have been deduced based on the function structure method.
- Information flow in plant control and monitoring system can be defined to represent the flow of energy, mass and data. Thus the implementation of function depended on the transformation of information flow.

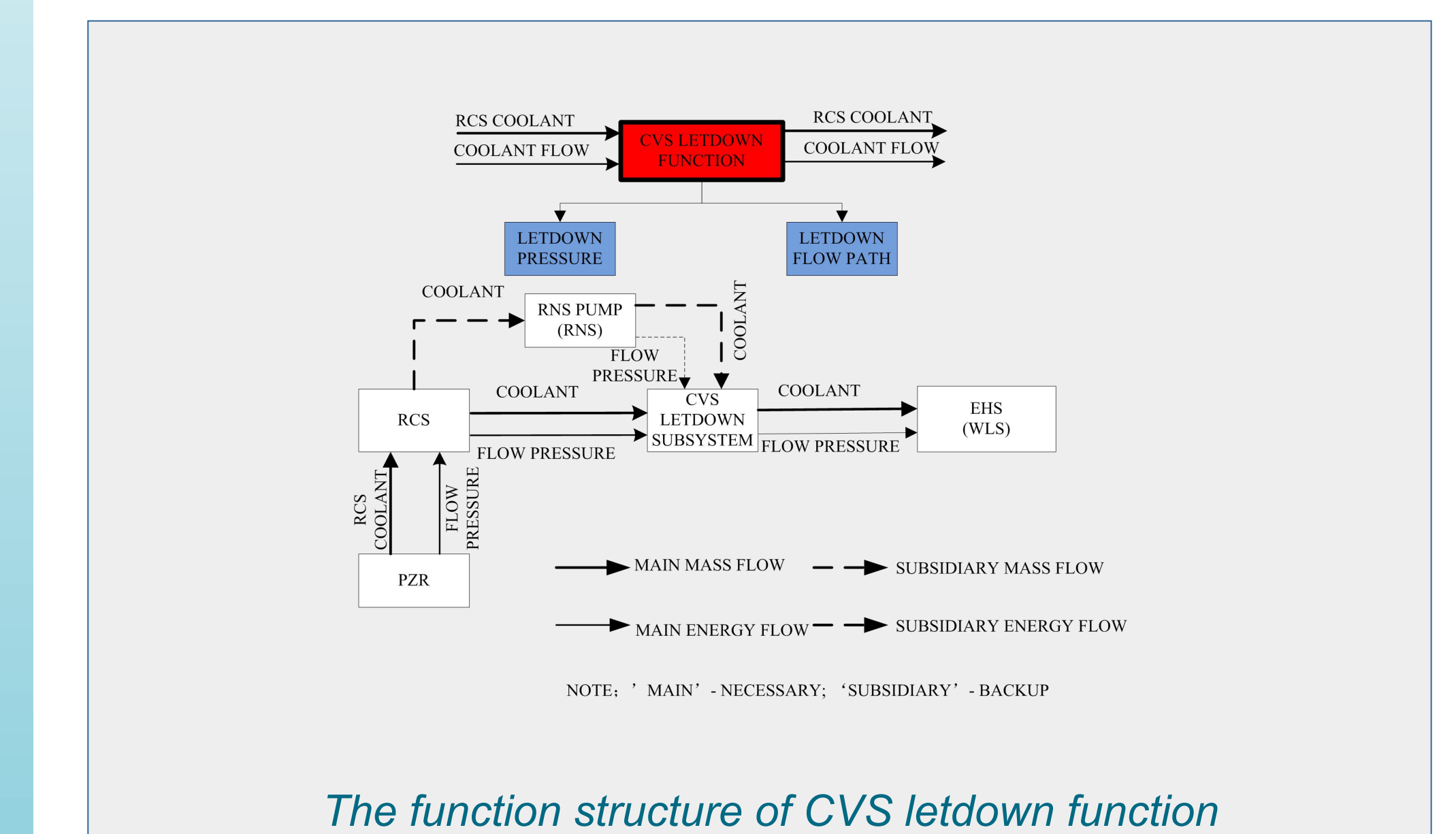


## Application Instance: Analysis

RCS inventory control function as major control function defined in URD has been selected as the example to illustrate the function analysis process based on the innovative function analysis method.



## Application Instance: Anlysis



### Note:

- the barriers of RCS has been identified as CVS, RNS, PXS, WLS, SFS
- CVS makeup=CVS makeup supply + CVS makeup pressure + CVS makeup flow path + Support system
- CVS letdown=CVS letdown pressure + CVS letdown flow path + Support system

## Conclusion

- The innovative method (the combination of function tree and function structure) has been proved to be more applicable.
- The function analysis of RCS inventory control function defined in URD has justified the validity of this new functional analysis model.

## Application Instance: Results

