International Journal of Research in Advent Technology, Vol.6, No.10, October 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

Implementation of Three Element Boiler Drum Level Control Strategy without Cascade Control and Feed forward Signal

Ashvani Kumar Shukla[1], Dr. Ritula Thakur[2]
Student, Department of Electrical (Instrumentation & Control) Engineering[1], Nitttr Chandigarh-160019, India[1]
Assistant Professor, Department of Electrical (Instrumentation & Control) Engineering[2], Nitttr Chandigarh-160019, India [2]
Email:shukla.cya75@gmail.com[1],ritula.thakur@nitttrchd.ac.in[2]

Abstract- Steam is used to produce the electricity in thermal power plant. The steam is generated from boiler and used to rotate the turbo-generator to produce electricity. In the process of steam production from industrial boilers three critical parameter are maintained that is water, air and fuel. Water is maintained inside the drum installed at the top of boiler. Steam drum also works as water steam separator. Water level measurement in the boiler drum is very critical and should be controlled at desired level during the frequent load variation. For smooth, continuous and reliable boiler operation, a constant level of water in the boiler drum is required to be maintained. Due to low water level it may damage boiler drum as well as tubes by overheating. If the water level goes high in drum, leads to improper function of separators, difficulty in temperature controlling and damage in super heater tubes. Due to water droplets enters inside the turbine may damage the machine due to thermal contraction. In this paper we have proposed the new close loop control of boiler drum level without using the feed forward loop. Generally in three element drum level control we use steam flow as a feed forward signal in cascade control. But in proposed loop we do not use the feed forward signal and it is more reliable during frequent load variation. It can be easily tuned with the help of some constants used in loop and we achieve smooth, reliable, safe, and economic operation and control of boiler.

Keywords- Boiler, Drum Level, Single Element Control, Two Element Control, Three Element Control.

1. INTRODUCTION

There are many parameters need to control in thermal power plant, drum level is one of them. The level of water in drum must be in specified level for smooth and efficient operation. If water level in boiler drum very low then the boiler tubes may damage and if the level will be very high then it may be possible to carry water droplets into turbine which will cause turbine blades damage. So drum level control require tight control strategy.

2. THREE ELEMENT CONTROL

Three element control method is used when the load is more than 30%. It is the best method for drum level control for handling load swing as well as neglecting shrink and swells effect in boiler drum. The three elements used in this control method are drum level, feed water flow and steam flow.

2.1. *Three Element control (With Cascade Control & Feed forward Signal)*

At present the three element control strategy using cascade and feed forward control method. In cascade control there are two loops, Primary loop is of drum level element and secondary loop is of feed water flow element, steam flow elements acts as feed forward signal for generating remote set-point for the feed water PID. Feed water PID compares this remote set point with the running feed water flow and generates output according to the error and tuning parameters. This is final output goes to FCV (feed water control valve) which is final control element. FCV responds as per output signal of the FIC. Three element control method is shown in figure-1. The compensated steam flow is calculated as follows:

Qc = Qm* Sq. root (Td + 273.14) / (Tm + 273.14)* Sq. root (Pm + 1.0332) / (Pd + 1.0332)

Qc = Compensated flow Qm = Measured flow

Td & Pd are design temperature and pressure.

Tm & Pm are measured temperature & pressure using TT & PT in the line.

Due to the two loops present the tuning of both loops must be fine. If any one of the two loops gets unstable then hunting starts in level control of steam drum. To overcome from two loop tuning we are analysing a new approach of three element control without cascade strategy and with a single PID.

2.2 Proposed Three Element Drum Level Control Strategy without Cascade Control and Feed forward Signal

is clear that closed loop become more stable and precise for drum level control. Similarly in cascade loop two PID are controlling but in proposed control Loop only single PID is controlling the drum level process. So it is more enhanced control loop for drum level control.it is faster and provide less hunting in the drum level monitoring and control.it also reduces the time of PID tuning due to single PID controller in place of two PID controller. Single PID is more reliable then the master and salve configuration.

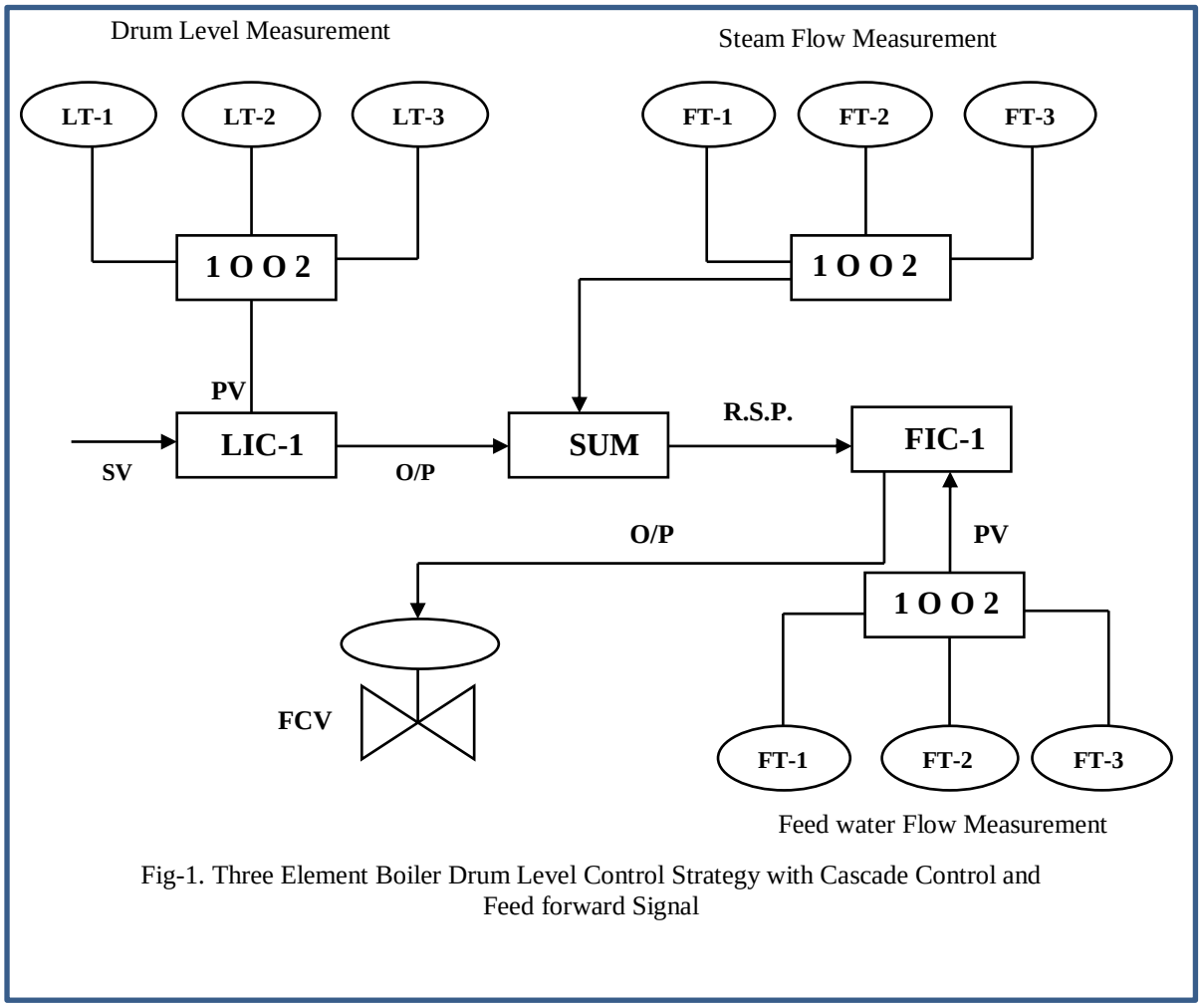

Fig-1. Three Element Boiler Drum Level Control Strategy with Cascade Control and Feed forward Signal

Most important modification in the proposed closed loop control of three element boiler drum level control is the elimination of cascade loop and feed forward signal in new closed loop control scheme. Feed forward signal directly affect the controller remote set point value and vice versa opening and closing of control valve. Sudden change in load cause change in feed forward signal value.it causes change in the controller output suddenly and hunting occur in drum level. Hence after elimination of feed forward signal it

3. CONCLUSION

In the proposed drum level closed loop control scheme only single PID controller is used. It is clear that master and slave configuration is removed.Responce of closed loop control will be faster as compare to the cascade scheme. One important factor is feed forward signal that is also removed hence this scheme become more and more stable for process and final control element life will increase and process deviation and hunting will be minimum.

Acknowledgments
I would like to express my deep gratitude to Dr.Ritula Thakur for his valuable and constructive suggestions during the planning and development of this research work. His willingness to give his time generously has been very much appreciated.

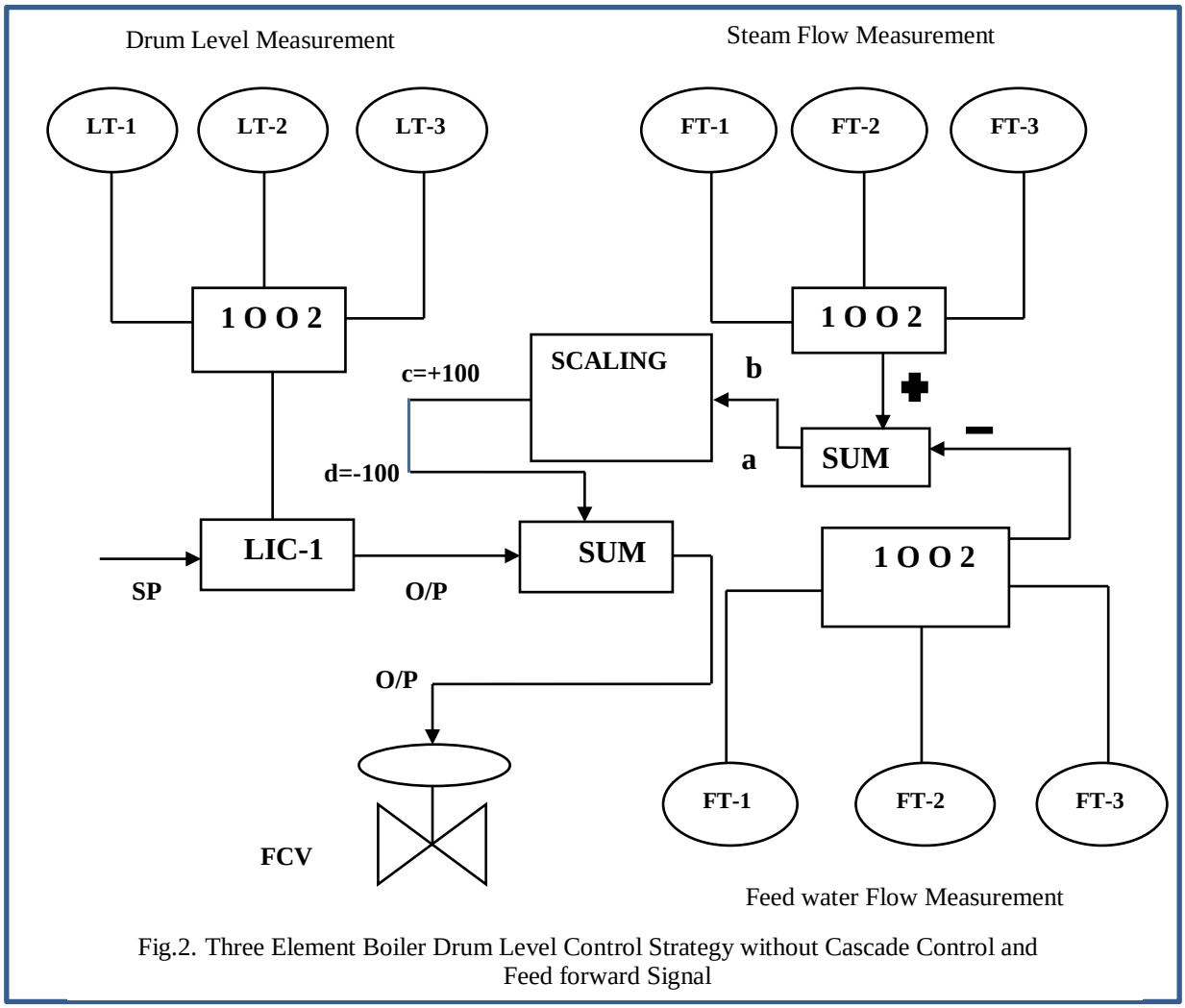

Fig.2. Three Element Boiler Drum Level Control Strategy without Cascade Control and Feed forward Signal

REFERENCES

[1] Oskoei, Mohammad reza Asghari, and Huosheng Hu. "Support vector machine-based classification scheme for myoelectric control applied to upper limb," IEEE transactions on biomedical engineering, Vol. 55, No. 8, pp. 1956-1965, 2008.

[2] Pradeep Shenoy, Kai J. Miller, Beau Crawford, and Rajesh P. N. Rao, " Online Electromyographic Control of a Robotic Prosthesis", IEEE Transaction on Biomedical Engineering, Vol. 55, No. 3, pp. 1128-1135, March 2008.

[3] Abidemi Bolu Ajiboye, and Richard F.ff. Weir, "A Heuristic Fuzzy Logic Approach to EMG Pattern Recognition for Multifunctional Prosthesis Control", IEEE Transaction on Neural Systems and Rehabilitation Engineering, Vol. 13, No. 3, pp. 280-291, September 2005.

[4] Shital B. S Onone, and G. D. Dalvi, "Real Time Control of Robotic Arm Using Electromyogram (EMG) Signals", International Journal of Science and Research (IJSR), Vol. 5, No. 1, pp. 797-800, February 2014.

[5] S. Sudarshan, and Dr. E. Chandra Sekaran, "Design and Development of EMG Controlled Prosthetics Limb", Proceeding of International Conference on Modeling and Optimization and Computing, pp. 3547-3551, 2012.