MOISTURE CONTROL IN FIBER BOARD MANUFACTURING

A dissertation submitted to the
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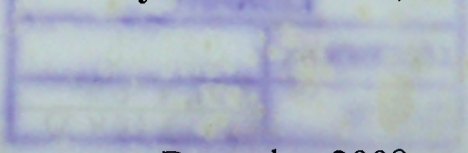
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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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Abstract

In fiber board industry, the moisture content (the moisture level) of fiber, perhaps the most critical parameter of fiber board manufacturing, works as the medium of heat transfer across the fiber mat while subjected to pressing in the hot press. The high moisture content splits (delaminates) the wood panel when decompressing due to the release of high steam pressure develops inside it where as the low moisture content split the panel as a result of low heat transfer causing a low level curing of resin inside the panel.

So controlling moisture is the most critical issue of the wood refiner operators which is a highly skill job that cannot be easily absorbed until having long time practice on it.

The fiber moisture content is controlled inside the dryer by adjusting the dryer outlet temperature set point. This set point is automatically maintained by the valve position of the steam PRV (Pressure Regulating Valve) of the heat exchanger, the only energy source of the dryer. In very cool climate conditions the air and the environment get cold where the dryer outlet temperature cannot reach the required set point even though the PRV is at its 100% open condition. In 100% valve open condition the system is supplied with maximum heat energy that can be given and the only way to further increase the outlet temperature is to make a change in the process. This change is done by using three parameters namely the blow valve position, the refiner feed screw speed and the differential pressure.

The mistakes in putting the correct set points and forgetting to put it on right time are human errors usually happen. This makes a heavy loss in the profit and restricts the consistency of the process.

To avoid this problem, the process of controlling moisture is fully automated with the four parameters mentioned, using a cascaded PID system coupled with a multistage controller. The cascaded PID takes moisture as the reference set point that controls the outlet temperature and this in turn controls the steam PRV. At the time when the PRV is at 100% open position the other three parameters work together as a multi stage controller in increasing the outlet temperature.

Acknowledgement

List of Figures

List of Principle Symbols

B_{Valve} The Blow Valve Position

RPM_{FS} The Refiner Feed Screw Speed in RPM

P_{diff} The Differential Pressure

T_{outlet} The outlet temperature of Air (Dryer outlet temperature)

$T_{outlet}^{100\%}$ The outlet temperature of Air when the steam PRV is at 100% open condition

T_{inlet} The inlet temperature of Air (Dryer inlet temperature)

$\Delta T_{B_{Valve}}$ The outlet temperature difference due to Blow Valve

$\Delta T_{(RPM_{FS})}$ The outlet temperature difference due to Feed Screw Speed

$\Delta T_{P_{diff}}$ The outlet temperature difference due to Differential Pressure

w_{fiber} Mass flow rate of fiber coming into the dryer

l_{fiber} Average length of a fiber

A_{fiber} Total area of fiber

PRV Pressure Regulating Valve