CONCLUSION

In this work, the two-interacting tank process was proposed to study its control. The typical control system to study the process control strategies was designed. The GUI was developed to support control on this process. In addition, the GUI can be controlled from remote area.

There were six groups of equipment shown as follow (i) computer: LabVIEW 8.0, IE 7.0, MAX 4.0, and MS Windows XP, (ii) basic equipment: stainless steel tank, PVC pipe, and globe valve, (iii) utility hardware: pump and compressor, (iv) signal conditioning, (v) final control element: control valve and heater, and (vi) sensor and/or transmitter: differential pressure transmitter and thermocouple type K.

The operation of this process can be described as follow. Firstly, the two identical size tanks are coupled together and they placed upper than the liquid source tank. Then, the liquid was only fed in the first tank at the same time the liquid in the first tank was heated by heater. After that, the hot liquid from the first tank flowed into the bottom of the second tank. Finally, the liquid from the second tank flowed to the source tank. It is difficult to control this process because the interaction effect of the tanks. However, the interacting control problem was solved by the decentralize control technique. This process was used 4-20 mA analog signal to communicate with signal conditioning box. This box was connected with data acquisition card in order to convert the analog to digital signal and *vice versa*. The level of tanks was measured by differential pressure transmitters, which the signal is 4-20 mA. The temperature in the first tank was measured by thermocouple type K, which the signal is degree Celsius directly. For convenient in control, the degree Celsius will be converted in the 4-20 mA form by analog signal splitter of Wisco. Nevertheless, the sensors and/or transmitters must be calibrated in order to obtain the correct controlled values for control. The trends of calibration curve are linear. Servo problem and regular problem were used to verify all control algorithms.

The GUI implemented by LabVIEW 8.0 was proposed and also generated into web-based style which the remote control via internet was developed and implemented. There were two GUIs control in this work, one tank control and two interacting tank control. Noted that the server computer must be turned on and be installed LabVIEW 8.0. The code of GUI is called “block diagram” which consists of functions and sub VIs developed by the user. Furthermore, sub VIs can be applied the controllers into the block diagram.

The methodology in this work can be divided into six cases

1. The first case is level increasing 3 cm and temperature increase 1 degree Celsius at the first tank.
2. The second case is level decrease 3 cm and temperature increase 1 degree Celsius at the first tank.
3. The third case is level of tank one and two set point increasing 5 cm.
4. The forth case is level of tank one and two set point decreasing 5 cm.
5. The fifth case is only level of tank 1 set point decreasing 5 cm.
6. The sixth case is only level of tank 2 set point increasing 5 cm.

In this work, four conventional algorithms; PID, IMC, GMC, and FLC were applied as sub VIs controller to effectively control on this process. It was found that all controllers provided satisfied close-loop response, but with slightly IAE and different rising time. The GMC has high efficiency control in temperature control loop. The temperature response can be fastest adapted to the new set point by this algorithm. Since energy balance equation is non-linear, GMC is suitable for non-linear model because it can be straightaway in the GMC algorithm so that they do not need to be linearized. For the level control loop, it is quite similar in the rising time. Level loop is easy to control because it has no transport lag time. The model of level loop is a linear that equation is not complicated.