

Thermal cycle fatigue of a ceramic plate:-

(fatigue - weakness in metal caused by repeated variations of stress)

Objective:-

- To investigate the use of a DAC to evaluate fatigue failure in a ceramic plate due to thermal cycling.

- The plates are first heated by a 3000°F by a quartz lamp for a length of time

- Then, the plates are allowed to cool in ambient air, about 75°F for a length of time.

- This method is an open-loop approach

- For closed loop approach - 2 actuators and one sensors are required.

2 actuators $\left\{ \begin{array}{l} \text{Heat lamp} \\ \text{[plate heating - ON/OFF]} \\ \text{Fan} \\ \text{[plate cooling - ON/OFF]} \end{array} \right.$

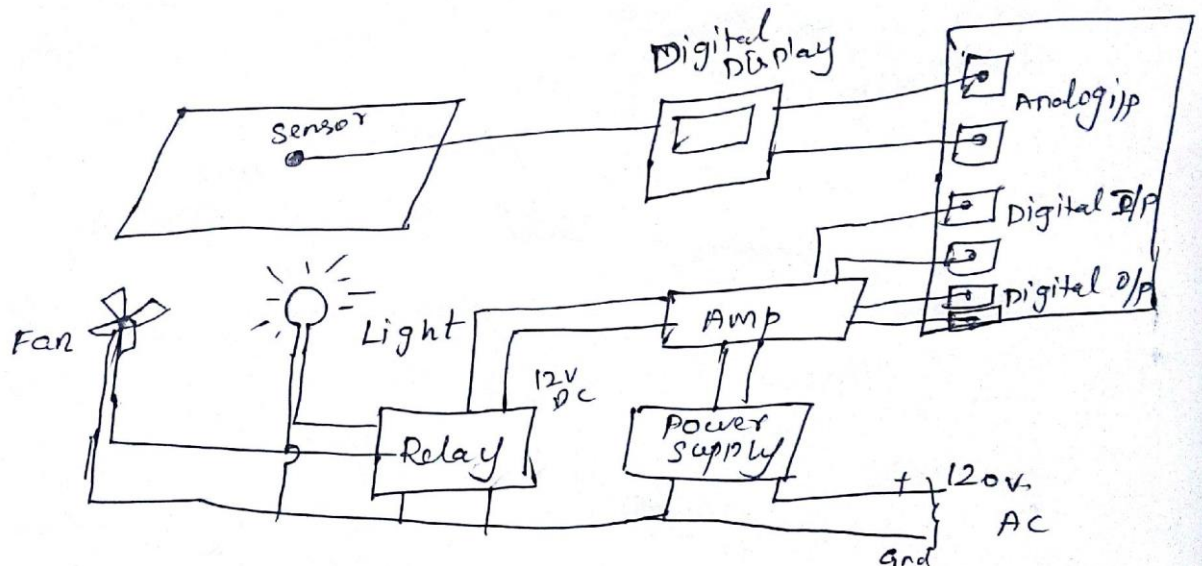
- a single thermocouple is required to sense the plate temperature.

Parts required:-

- 250 watt heat lamp
- 2 speed fan
- Aluminium test specimen
- k' type thermocouple
- temperature display unit
- DC power supply
- Other I/O Components

Experiment:-

- an application which cycles the temperature a plate in a controlled manner is developed.



- it is based on 2 temperature set point
 - * Ambient temperature (atmospheric temp)
 - * Hot temperature (120°F)

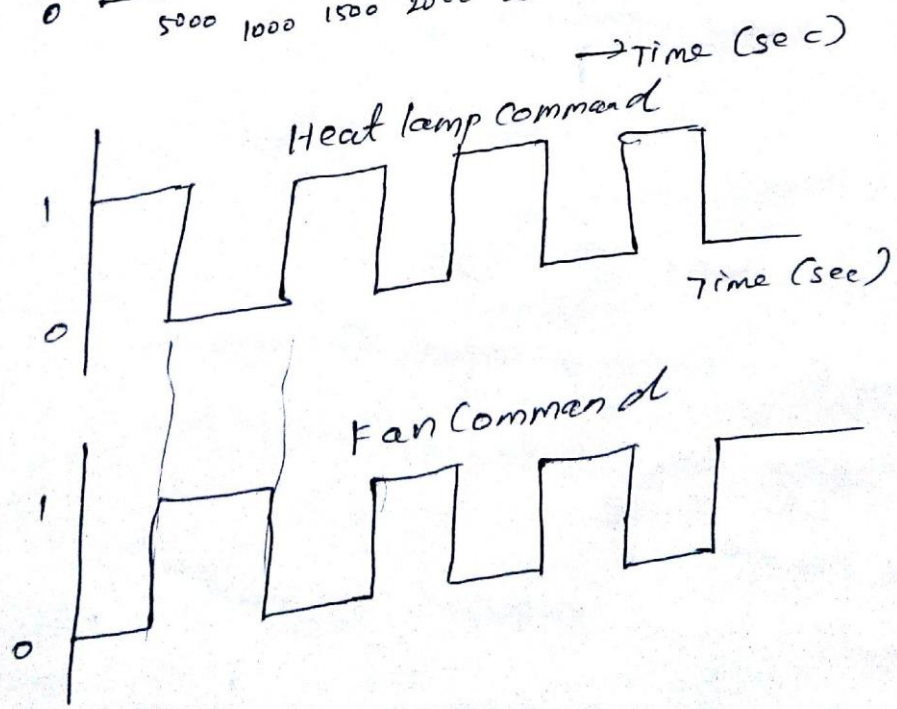
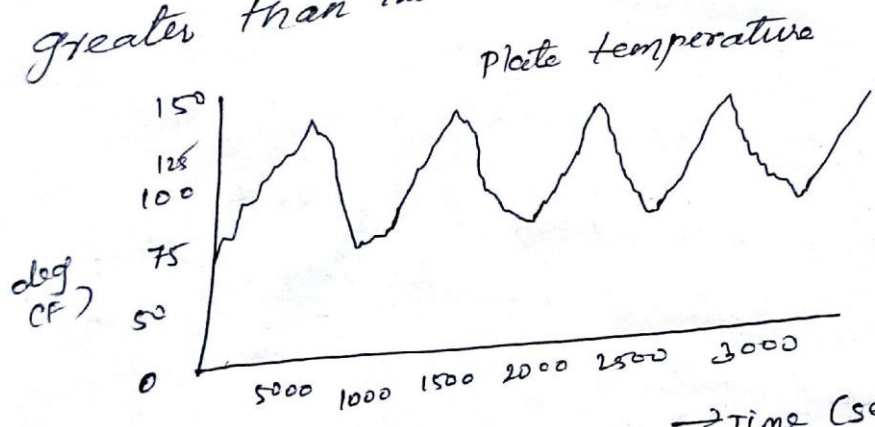
- Beginning with the plate temperature at ambient, the heat lamp is turned on and the plate temperature continuously monitored using the thermocouple until it reaches the hot set point value.

- The heat lamp is then turned OFF and the fan turned ON, when the plate temperature is ambient, the fan is turned OFF, and the procedure is repeated.

- The digital I/O are used to turn the fan and heat lamp ON and OFF.

- The Controller is logic based and its operation is described by the statements below,

- * The heat lamp is ON when the plate temperature is less than the hot setpoint and the fan is OFF.
- * The fan is ON when the plate temperature is greater than the cold setpoint and the heat lamp is OFF.



- The Controller is implemented to precisely satisfy these two statements with one caveat. ³
- Sensors tends to noise, & methods are often employed to remove noise,
 - * External hardware filtering
 - * desensitizing the processing algorithm.