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Simulation of Controller for Heating Temperature and Processes Optimization

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Abstract: The pasteurization process system model for milk causes many problems and rejection and needed to be improved. In pasteurization process by heating temperature properly use and control, it is possible to minimize the predictable pathogenic bacteria. In present time when manual and conventional controller is still used at different plants, the heating temperature will act to optimize the process for optimum results. In this study, unimproved controller was developed to maintain temperature stability during the milk pasteurization process. A first principle model of plate heat exchanger based on system's power balance equation is established, or its transient or steady-state response is attaining by final dissimilarity method.

Keywords- Pasteurization, Heater, Ziegler Nichols, Final dissimilarity method, MATLAB.

I INTRODUCTION

Pasteurization is now common process of destroying microorganisms by heating a liquid at the desired temperature for desired time. It is useful to reduce milk-borne diseases and to increased milk life. The products are heated or cooled in batches in one or different tanks, without affecting the taste or nutritional value. The liquid products are heat treated in a continuous system by using a plate heat exchanger. The heating and cooling process are designed to inhibit a phase change. The food acidity used to determines the time and temperature of the heat treatment as well as the duration of shelf life. It is possible to use software without spending time or expensive equipment design and models for exchangers and control loops [1].

Controller simulation process requires a precise model that takes into account warmth dynamics over the entire length of countercurrent heat exchanger so that the controller can be adjusted. For it, feedback manager is used to mechanically manage procedure or process. The simulation control scheme evaluate value or state of process variable (PV) to a proscribed value or the set value (SP) or uses the dissimilarity as a manage signal to make procedure inconsistent output from factory reach the same value as control variable. For chronological logic or combination logic, software logic is used [2]. The proportional controller must work with any remaining errors in the system. Although PI monitors eliminate defects, but they are still slow and inaccurate. In spite of the availability of many approaches for setting the parameters of PID controllers, the stability investigation of time-delay schemes that usage PID controllers remnants tremendously tough, and there are very few prevailing solutions on PID controller [10].

PID controller used to regulate the variables like pressure, speed, temperature etc. The PID controller solves the final faults by incorporating differential motion (D) to maintain stability and improve response efficiency. The combination of appropriate and neutral functions and derivatives is often referred to as PID activity, hence it is also called PID controller (proportional-integral-derivative). These 3 crucial coefficients vary from PID controller to detailed function to get best results [9].It receives input signals from sensors. It also acknowledges the output of the required actuator and then calculates or merge appropriate, consistent, or derivative comeback to calculate output of actuator. The exactness of the low order model resulting from PID rejoinder and high order FOPID can be adjusted by Ziegler Nichols.

II LITERATURE SURVEY

Time delay system with PID controller may emerge as portions of internal dynamics or may result due to actuators or sensors utilized. Communication delays amongst dissimilar portions of a scheme are also cause of this phenomenon. Presence of time delays may cause oscillations or even unpredictability; furthermore it confuses investigation or control of these schemes [3]. Freshly, there has been a great concentration in alleviating high order schemes by low fixed order manager. A PID controller is an electrical element for decreasing the error value amongst an anticipated set point and a definite calculated procedure variable. The PID controller functions rendering to its input parameters that need to be set before its lane [4]. The optimal ethics of these parameters must be found at the time of the so-called tuning procedure. It is well known that the conservative PID controller will provide better transitory and steady state replies, when the organization parameters remain unaffected at the time of operating conditions, but the parameters of the practical schemes alteration at time of operating circumstances [7].

As a solution, the PID controllers failed to provide anticipated performance under load disturbances, nonlinearity or parameter variations of motor or load. This has occasioned in an upsurge in request for nonlinear controllers, intellectual and adaptive controllers. The result seemed in the field of PID controllers, counting their design, investigation and synthesis are dogged to measure the time delay scheme functions [5]. It emphases on linear time-invariant plants that may comprise a time-delay in the feedback loop set optimization solutions. Computational process for influential the group of all stabilizing manager, of a provided order or edifice, for linear time invariant delay free schemes are described in literature. In this line of investigation, chief impartial is to calculate stabilizing regions in parameter space of simple controllers as stabilization is a primary and indispensable stage in any design issue. Once group of all controllers of a provided order and edifice is resolute, additional design criteria can be further. To this conclusion, numerous methods are engaged [6]. Graphical approaches were utilized to regulate all stabilizing parameters of a PID controller implemented to second order plants with dead time. A low-level two-input two-output model was used to model each part of the plate heat exchanger in a milk pasteurization plant [8].

III IMPROVEMENT NEEDED IN PASTEURIZATIONPROCESS

The taste and quality of products is the main criteria which satisfy the customer and promote for continuous use of milk products. To automate the milk pasteurization process, a controller with PID control is used to minimize the heating process cycle. The order of model is deliberately lowered because it is used in model with predictable control strategies. After making some necessary change to the model or filling in the system process parameters (volume, flow rate, heat transfer coefficient, etc.) the results obtained are very poor or it is necessary to temporarily change the time constant or amplify to obtain reasonable results. Since there is almost no correlation between the model or actual physical parameters of system, confidence in the model is reduced. The dissimilarity among first principle model developed in this paper or process is that each part of heat exchanger is segmented using final difference method to create a lumpy parameter model.**Figure-1 & 2** indicates PID Controller working diagram and design. The PID temperature controller can effectively manage time and keep the temperature in the pasteurization process stable.

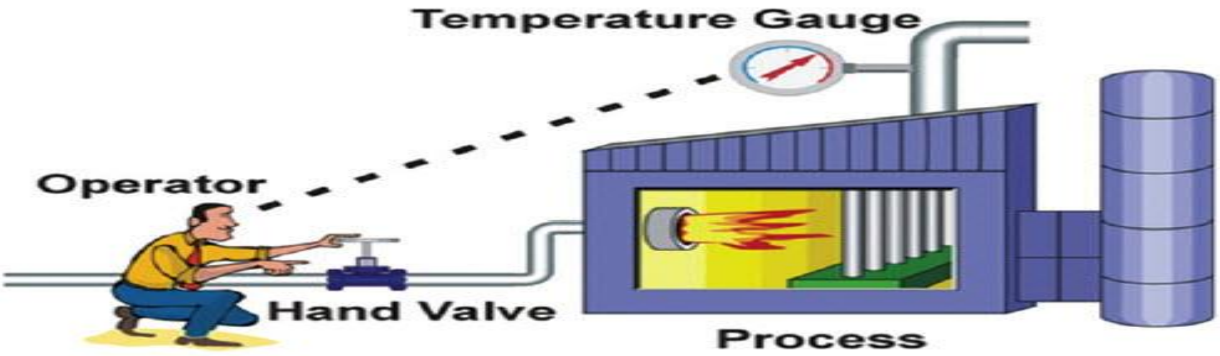

Figure-1 PID Controller working diagram

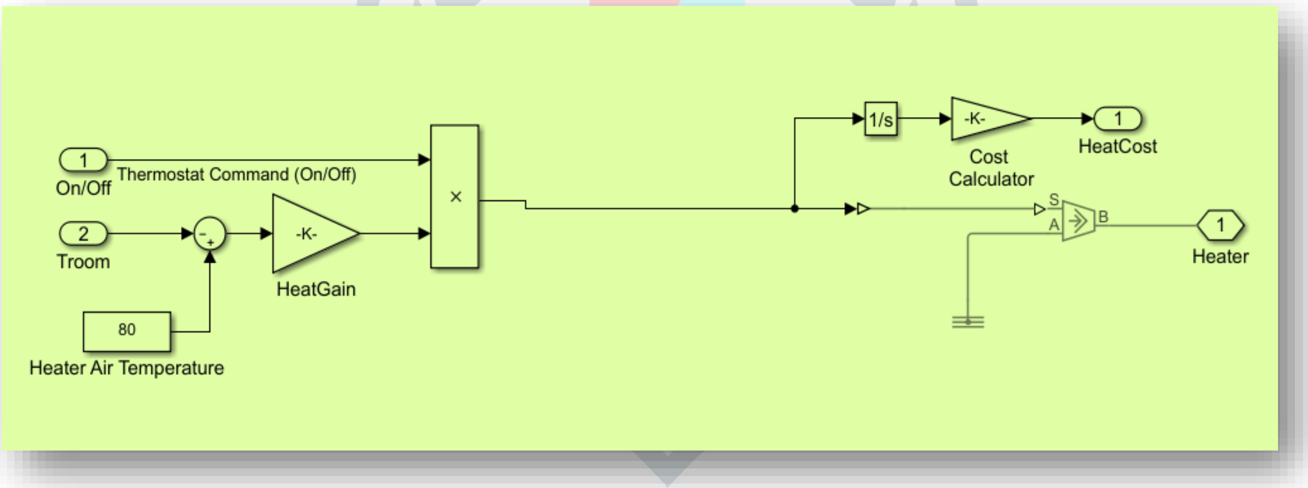

Figure-2 FOPID Controller Design with Heater Unit

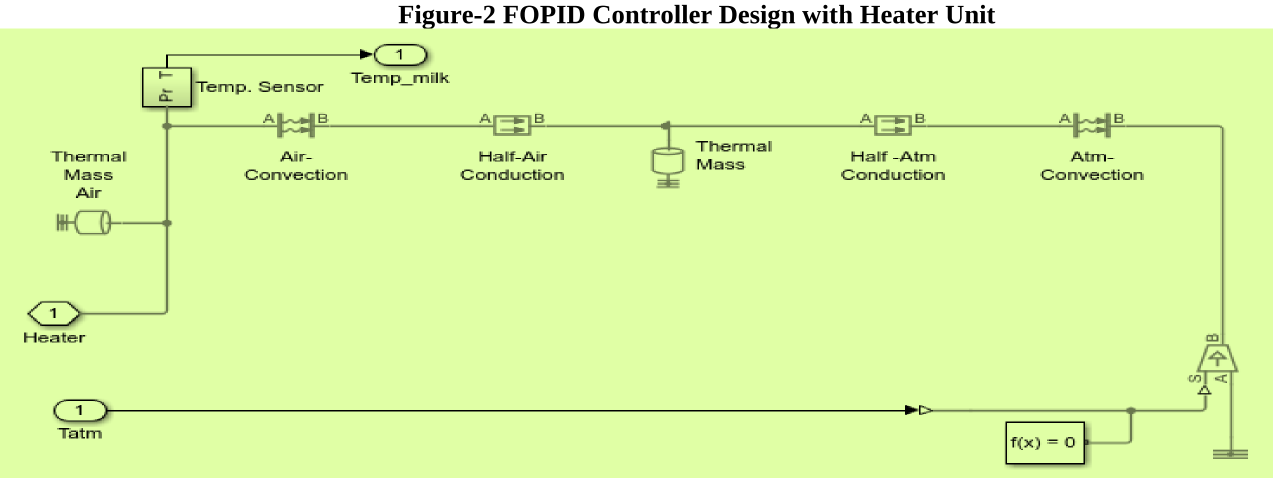

Figure-3 Thermal Network FOPID Controller Design

IV PID CONTROLLER DESIGN:

On / off control, PID controls conclude accurate output value. The output influence range is 0 to 100%. When using analog output type, the output drive is comparative to output influence value. If output is a binary output type (such as a relay, SSR driver), output must be time-proportioned to attain an analog depiction as in **figure-3**. The time-proportional organization uses a cycle time to scale output value. If cycle time is set to 8 seconds, a classification that involve 50% power turns on output for 4 seconds or turns off for 4 seconds. As long as power value does not modify, occasion value does not modify. As time goes on, current averages 50% of command value with half open or half closed. If output authority is to be 25% in same cycle time of 8 seconds, output will be on for 2 seconds and then off for 6 seconds as in **figure-4**.

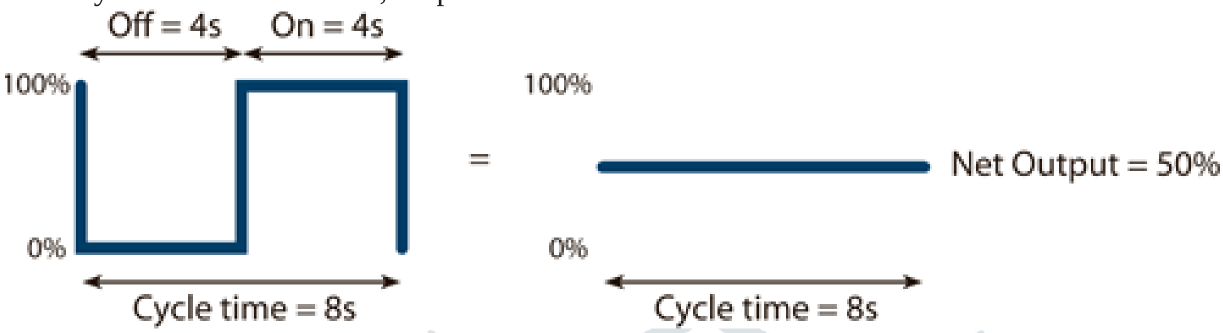

Figure-4: On / off control, PID controls

With same conditions, a shorter cycle time is required because manager can respond faster or change output state of a given change in procedure. Due to principle of the relay, a shorter cycle time shortens life of relay, so it is recommended not to be less than 8 seconds. For solid-state button devices (such as SSR drives), faster button times are better. The barrier represents the most efficient source of energy in a thermal complex, which can continue a certain rate of flow of heat regardless of temperature distinction. The flow of heat is regulated by S signal port. The positive flow is from port A to port B.

V. RESULTS & DISCUSSIONS:

The final results attain using this model is very precise and with minimum heating time. The overall goal of P (proportional), I (integrated) and D (differential) is to accelerate the reaction rate of the system, eliminate displacement and produce major initial changes (oscillation Though, if the development constraint is set to Matrix (*), a single * in block output environment results unmovable and a single / results in block output environment opposite as in **figure-5**.

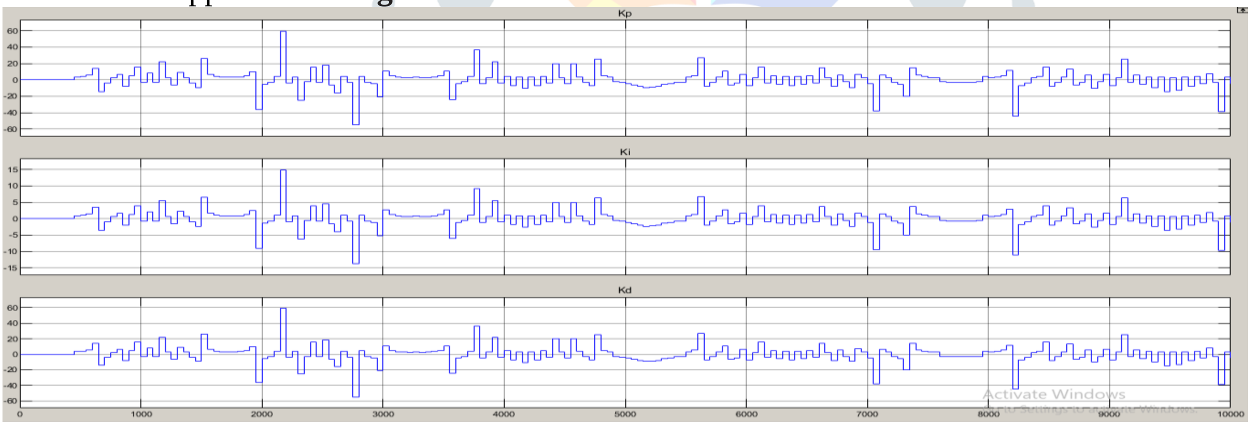

Figure-5: K_P, K_i, K_d response of the FOPID Controller

Figure-6 shows the cost output of the FOPID controller at 2.5000e-08 gain calculated by elemental gain (y = K. * u) or matrix gain (y = K * u or y = u * K) Out. The x-axis here shows the maximum heating cost, and the y-axis shows the simulation time.

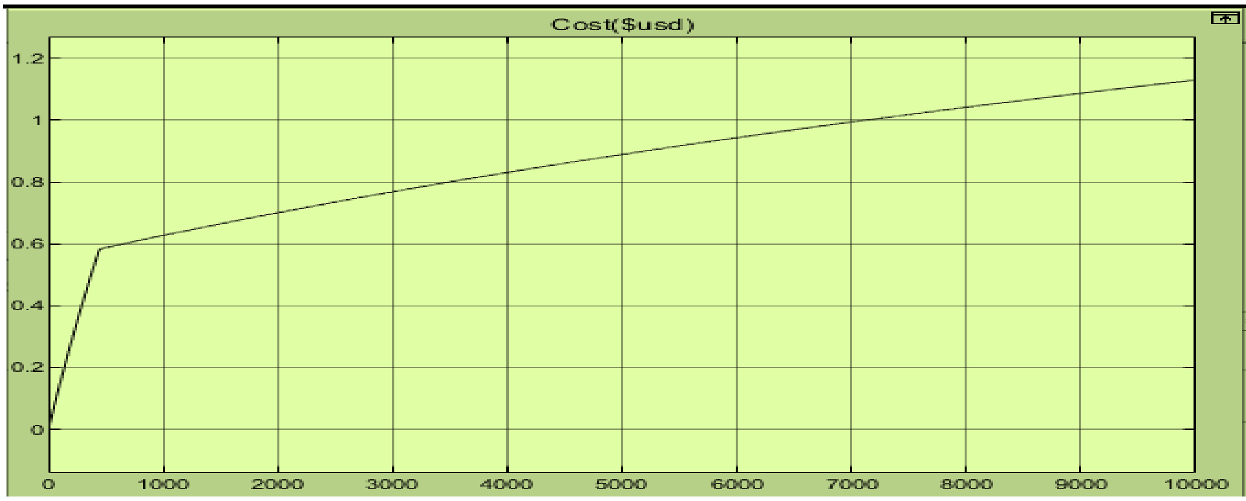

Figure-6: Cost output of FOPID controller

Specify the output port of subsystem or model. The "output when immobilize" or "initial output" parameters apply only to provisionally implement subsystem. When the conditionally implement subsystem is immobilize, output remains at last value or set to "initial output".

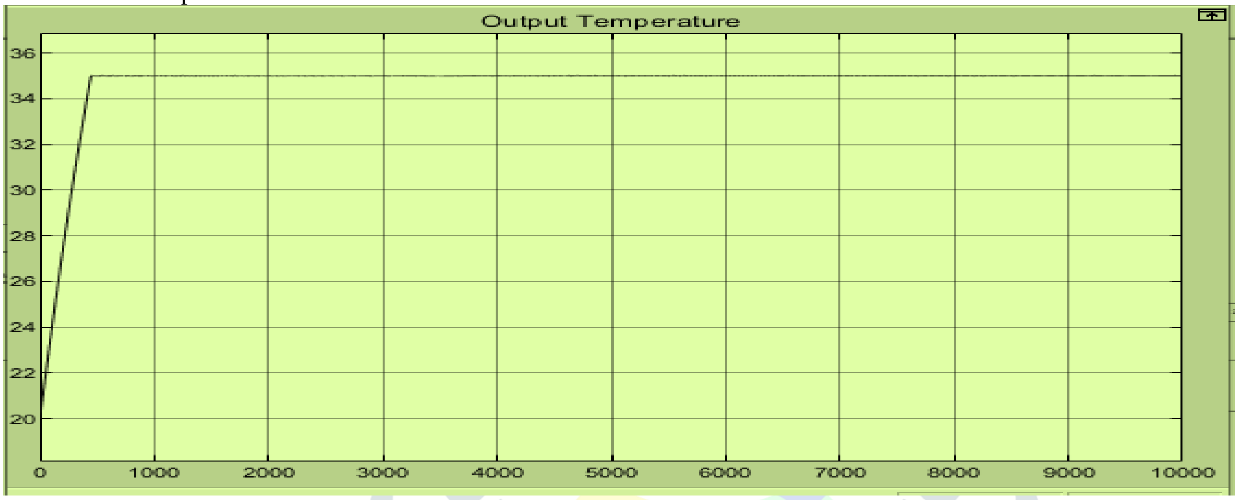

Figure-7: Out temperature of FOPID Controller

Figure-7 shows the output temperature here, the x-axis shows replication time, y-axis shows constant temperature of 70 degrees and the constant specific by "constant charge" parameter is output. If "constant value" is a vector, or "interpret vector parameters as one-dimensional" is enabled, invariable value is treated as a one-dimensional array. If not, match a matrix with same size as invariable value as in **figure-8**.

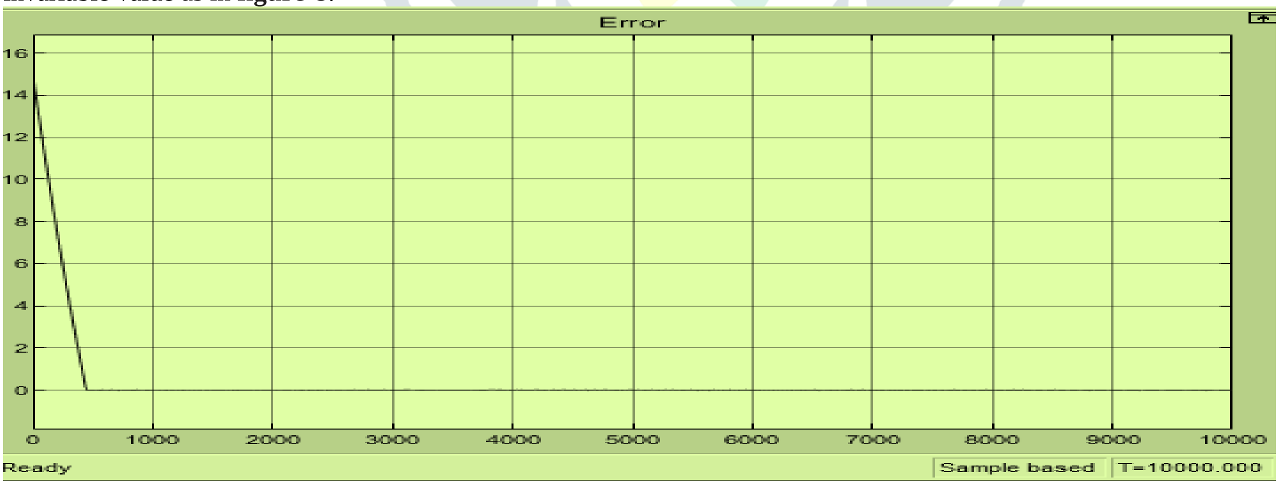

Figure-8: Temperature of FOPID Controller

Output constant specified with "constant value" limitation. If "constant value" is a vector, or "construe vector parameters as one-dimensional" is enabled, invariable value is treated as a one-dimensional array. if not, match a matrix with same size as constant worth.

Element-wise gain (y = K.*u) or matrix gain (y = K*u or y = u*K)., Element-wise gain (y = K.*u) or matrix gain (y = K*u or y = u*K).Specify the output port of the subsystem or model. The "output when disabled" or "initial output" restriction apply only to provisionally implement subsystem. When the conditionally implement subsystem is immobilize, output remains at last charge or set to "initial output". Figure 4.13 shows the cost output of the FOPID controller at 2.5000e-08 gain calculated by elemental gain (y = K. * u) or matrix gain (y = K * u or y = u * K) Out. The x-axis here shows the maximum heating cost, and the y-axis shows the simulation time

During The Simulation Input Value is set at 35 at 70degree.Output constant specified with "constant value" parameter. If "invariable value" is a vector, or "interpret vector parameters as one-dimensional" is enabled, the constant value is treated as a one-dimensional array. or else, match a matrix with same size as constant value.

IV CONCLUSION

The simulation of PID controller on MATLAB helps to optimize the milk pasteurization process. A scalar value denotes number of input ports to be reproduced. For example, 2 performs the operation 'u1*u2'. If there is only one contribution port or "multiplication" parameter is set to elemental (. *), A single * or / will use specified operation to fold the input signal. The model urbanized using finite distinction techniques establish to be very correct in predicting output of process. In addition, if conditions change, or physical properties are underestimated or overestimated, minor changes in physical goods of PHE may lead to more correct results. Low-order dual-input dual-output model composed of first-order or first-order plus dead-time models derived from transient reaction from high-order final disparity model is also very accurate, or difference between the two is very small. The implementation of model predictable control strategy with low level model can be useful. The PID Live tuning developed using the Ziegler Nicholas method has been developed and tested in MATLAB Simulink together with PID and FOPID controllers, and the results are satisfactory. Today, these types of circuits can also be used on great farms or places where we want to quantify current temperature or keep temperature invariable according to the user's conclusion.

As a consequence of the investigations carried out in this work, the following aspects are identified for future research work in this area. The training and testing patterns for the ANFIS and ANNC are taken from PI controller data. Instead of PI controller data pattern, the data can be taken from tuned PID controller and the STATCOM can be tested using the PID patterns. The hardware set up is a reconfigurable one. Hence, the work can be extended to SSSC and UPFC. The same four controllers can be designed for the SSSC and UPFC.

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