**Results from Simulations**

The first identification was done without an addition excitation, the only input is the controller output. To make the results consistent, the same random seed was used for noise simulation.

The proposed was tried successfully with a sampling interval of 1 time unit. The identification is done recursively along with the testing part. The quality of the model is calculated using the error between the process output and the predicted output. The time window is the time span used for testing, for example, a 5 minute window implies how well the current parameters will predict the process behaviour for the next 5 minutes. The tables below show the time at which the model converges i.e. high quality and small error between the model output and the process output.

It is expected that the less time window or the less time to test the model, the less qualitative results obtained because there is not enough time to capture all the process behaviour and the faster the error will converge to zero.

**Time for verification = 5 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 19.9 | 500 |
| Run 2 | 19.85 | 500 |
| Run 3 | 19.86 | 500 |
| Run 4 | 19.97 | 500 |
| Run 5 | 20.48 | 500 |

Average = 20.012 time units

**Time for verification = 10 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 44.46 | 500 |
| Run 2 | 44.62 | 500 |
| Run 3 | 45.0 | 500 |
| Run 4 | 44.56 | 500 |
| Run 5 | 44.26 | 500 |

Average = 44.58 time units

**Time for verification = 15 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 64.26 | 500 |
| Run 2 | 65.04 | 500 |
| Run 3 | 64.68 | 500 |
| Run 4 | 65.31 | 500 |
| Run 5 | 64.62 | 500 |

Average = 64.782 time units

**Time for verification = 20 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 91.92 | 500 |
| Run 2 | 91.24 | 500 |
| Run 3 | 92.32 | 500 |
| Run 4 | 93.76 | 500 |
| Run 5 | 90.44 | 500 |

Average = 91.936 time units

**Time for verification = 25 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 134.3 | 500 |
| Run 2 | 129.45 | 500 |
| Run 3 | 129.85 | 500 |
| Run 4 | 133.75 | 500 |
| Run 5 | 131.45 | 500 |

Average = 131.76 time units

**Time for verification = 30 time units**

|  |  |  |
| --- | --- | --- |
| **Runs** | **Convergence Time** | **Converged Samples** |
| Run 1 | 200.740740741 | 486 |
| Run 2 | 193.217213115 | 488 |
| Run 3 | 200.76446281 | 484 |
| Run 4 | 204.12371134 | 485 |
| Run 5 | 203.888888889 | 486 |

Average = 200.547 time units

The figure above shows an increase in the convergence time with increasing time window as expected