PID controllers have been used to control various high-assurance control systems, such as artificial pancreas and unmanned aerial vehicles. To assure and maintain correct control of the system, the controller’s PID parameters must be constantly tuned. Therefore, the topic of PID control tuning has generated a wealth of research, resulting in nearly 50 patents issued between 1990 and 2000 to address this issue.

In this thesis, we suggest a new technique for tuning parameters of PID controller using a combination of Bayesian statistical model checking and high-performance computing. The correctness expectation from the control system is specified using probabilistic linear temporal logic and the environment is modeled as a stochastic system. Our algorithm probabilistically guarantees that the tuned PID controller will enable the high-assurance control system to satisfy the safety and performance expectations.