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# GPC DESIGN TECHNIQUE BASED ON MQFT FOR MIMO UNCERTAIN SYSTEM

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Abstract. *According to the properties of the generalized predictive control theory and quantitative feedback theory, this paper presents two combined robust control methods. The first method uses MQFT to conquer plant uncertainty and stabilize the system. And the multivariable GPC (MGPC) controls the system which has been preparatorily controlled by MQFT. Two closed loops are used in this design approach. Any kind of MQFT and any kind of MGPC can be used to realize this control technique. This method also includes the advantages of GPC and QFT. The second method is different from the first one because the single-input single-output (SISO) GPC is used in the outer loop. As the first method, using MGPC, it needs more calculation time and memory. But its application area is rather wide and its performance is better than the latter. In GPC and MGPC, the model is identified with the system input and output online. If some of the specifications are changed, the MQFT controller needn't be redesigned in the proposed methods since GPC can adapt to the changes. They can also be used to control unstable plants. Finally, the simulation shows that the integration of GPC and QFT have better performance than if only one of them is used.*

**Keywords:** Generalized predictive control (GPC), Multivariable quantitative feedback theory (MQFT), Robust control, Multivariable uncertain system, Frequency domain design

1. **Introduction.** There is uncertainty in almost all systems. It is very important to control uncertain system. Quantitative feedback theory (QFT) is very powerful to control uncertain systems [1-3]. QFT can be used to control linear/nonlinear time variant/invariant systems [4,5]. However, if some conditions are not quantitated when design QFT controller, QFT can't assure the control performance and even makes the system unstable. Furthermore, QFT is difficult to use in some uncertain systems, since it should be redesigned if a little change is made in target controlling performance. Because it is somewhat difficult to control the cross-coupling plants with high uncertainty using a single technique, it is normal to turn to the combined methods [6,7]. But as these controllers are also fixed, it means they are not adaptive.

GPC is a useful algorithm based on the system model [8,9]. If the model is identified online, its robustness will be enhanced. However, it doesn't take the system uncertainty into account in the cost function, the uncertainty has some backward effects on the controlling performance.