

## Science Bridges China Research Profile

**Name:** Ke YAO  
**Position:** Manager/Research Associate  
**Institute/division:** HKUST Fok Ying Tung Research Institute  
Center for polymer processing and systems  
**Email:** [keyao@ust.hk](mailto:keyao@ust.hk)  
**Tel:** 8620-34685678



### SUMMARY OF MY RELEVANT RESEARCH AREAS:

*Process control, profile setting, optimization, process monitoring, fault diagnosis, and sensor technology in polymer processing*

高分子成型过程的控制、参数设定、优化、监测、故障诊断、检测等自动化技术

### Primary Research interests:

**Center for Polymer Processing and Systems**, directed by Prof. Furong Gao, is focused on the R&D of advanced system technologies in polymer processing area, including process control, profile setting, optimization, process monitoring, fault diagnosis, and sensor technology.

The product quality is a function of the processing conditions, so an accurate control system for key process variables is necessary to ensure good repeatability of the process. Based on features of injection molding and polymer extrusion, we are developing advanced control algorithms and strategies to realize the closed-loop control of the key parameters, such as injection velocity, packing pressure, plastication screw rotation speed, barrel temperature, etc.

Producing a qualified product is determined by the proper parameter setting. Therefore, we studies how to determine the optimal settings for key variables, i.e., injection velocity profile in the filling phase, packing pressure profile in the packing phase, and melts and mold temperatures throughout the cycle.

The function of process monitoring system is to detect, identify and remedy changes in the process that may cause the operation and quality to deviate from their desired settings. Some batch-to-batch variations in quality can occur due to process fluctuations, changes in materials, and unknown disturbances. Online monitoring of the process is important not only to ensure process operation safety but also to the final product quality consistency. Upon the moment of the process is detected to be abnormal, the fault diagnosis module kicks in to identify the sources causing the abnormality.

Quality is the ultimate goal of the molding process. However, there lacks the on-line quality measuring technology and instruments. We have developed an advanced quality transducer, which is installed in the injection molding mold, to on-line measure key qualities. The transducer can measure in-mold melt flow rate during filling phase, product weight during packing phase and product cooling rate during cooling phase.

### Topics in which you would like to develop collaborative research:

To develop automatic parameter profile setting technologies in injection molding based on the combined consideration of system technologies and polymer material characteristics.

### Relevant existing collaborations (academic/clinical/commercial) inside or outside China.

Include here any relevant collaborations you have

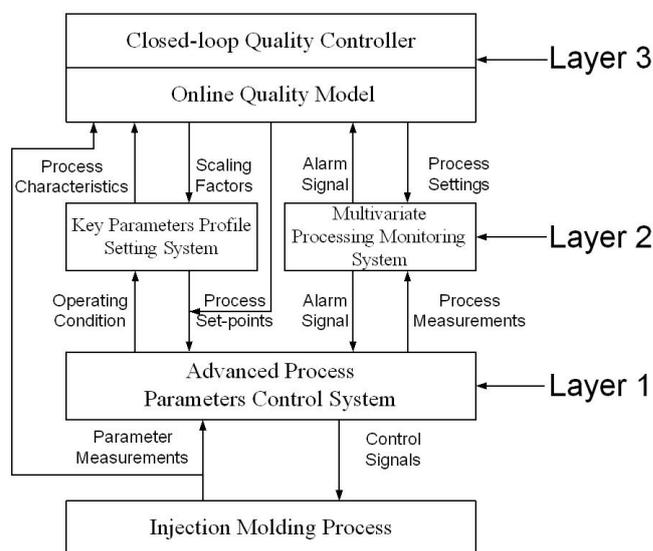
Collaborate with China National Engineering Research Center of Industrial Automation to establish a sub-center in South China area, focusing on the control technologies for batch processes.

Collaborate with South China University of Technology to develop a injection molding controller for injection molding machine

Collaborate with some injection molding machine manufacturers in China to develop control system for injection molding machine, including hybrid machine and all-electric machine.

### Relevant graphics, figures, pictures:

Use this area to show pictures or scientific figures which illustrate your research



3-layer structure of intelligent control system

### Publications and other outputs relevant to your interest in this programme (up to 5)

Please give references to your key recent research publications

Yi Yang, **Ke Yao**, Furong Gao \*, "Overall Control System for Injection Molding Process", *International Polymer Processing*, 27(1), 40-59, Mar. (2012)

**K. Yao** and F. Gao, "Faster process stabilization for injection molding by automatic profiling of plastication rotation speed", *Proceedings of the Polymer Processing Society 26<sup>th</sup> annual meeting, Banff, Canada*, (2010)

Yi Yang, **Ke Yao** and Furong Gao, "Design of an advanced injection molding control system", *SPE ANTEC Tech. Papers*, 1772-1776 (2010)

**Ke Yao**, Yi Yang and Furong Gao, "On-line in-mold transducer in injection molding", *SPE ANTEC Tech. Papers*, 1789-1793 (2010)

Yuan Yao, Yi Yang, **Ke Yao** and Furong Gao, "The applications of multivariate statistical methods in injection molding process monitoring", *SPE ANTEC Tech. Papers*, 1783-1788 (2010)