The project by Prof Furong Gao and the Zhejiang University research team (who are former MPhil/PhD students and researchers of HKUST) achieved major breakthroughs in process modeling; process control; process monitoring and quality prediction; process optimization; and new quality measurement technology. In process modeling, the project originated the model migration method based on process similarity. In process control, the project revealed the two-dimensional dynamics of batch process for the first time and proposed 2D control algorithms accordingly. In process monitoring, the project proposed the multi-phase and phase-transition concepts for the first time and proposed a series of online monitoring, fault diagnoses and quality prediction methods. In process optimization, the project originated the model-free-optimization, using the online quality data instead of quality model, and significantly improved the efficiency of batch process quality optimization. In new measurement technology, the project creatively developed a capacitive transducer for injection molding molds and provided a new technology for quality online measurement.

The project put forward and resolved some key theoretical problems in control of batch processes and laid a good foundation for establishing related theory and system method. It also leads the direction of research and development in some related areas in the world. The research results have broad application prospects and are set to lay a scientific foundation for the transformation and upgrading of manufacturing industries. Industrial application of the research includes the batch process control algorithms, which have been well applied to injection molding process, a typical batch process, and excellent results have been achieved. The team has started the research since 1995.