

J. C. Yu, Z. F. Liang and T. R. Hung, "Evolutionary regional network modeling for efficient engineering optimization," *2014 IEEE Congress on Evolutionary Computation (CEC)*, Beijing, 2014, pp. 1258-1264.

doi: 10.1109/CEC.2014.6900296

Abstract: This study presents a soft computing based optimization methodology, the evolutionary regional neural network modeling for engineering applications with sampling constraints. Engineering optimization often involves expensive experiment costs. Intelligent optimization advocates establishing a neural network model using small training samples such as orthogonal array to set up a surrogate model for the engineering system followed by an optimum search in the model to reduce optimization cost. However, scarce training samples might compromise modeling generality for a complex problem. Empirical rules suggest reliable predictions are likely restricted to the neighboring space of training samples, and interpolating designs are more reliable than extrapolating designs. To avoid imperfection of model due to small learning samples, an evolutionary regional network model is set up to confine the search of quasi-optimum using genetic algorithm. The constrained search in the regional network model provides a reliable quasi-optimum. The verification of the optimum is added to the learning samples to retrain the regional network model while the size and the distribution of reliable space will evolve intelligently during the optimization iteration using a fuzzy inference according to the prediction accuracy. An engineering case study, the optimal die gap parison programming of extrusion blow molding process for a uniform thickness, is presented to demonstrate the robustness and efficiency of the proposed methodology.

keywords: {blow moulding;extrusion;fuzzy reasoning;genetic algorithms;interpolation;iterative methods;learning (artificial intelligence);neural nets;production engineering computing;search problems;constrained search;engineering optimization;engineering system;evolutionary regional network modeling;evolutionary regional neural network modeling;extrapolating designs;extrusion blow molding process;fuzzy inference;genetic algorithm;intelligent optimization;interpolating designs;optimal die gap parison programming;optimization cost reduction;optimization iteration;orthogonal array;quasi optimum search;sampling constraints;small learning samples;small training samples;soft computing based optimization methodology;uniform thickness;Accuracy;Artificial neural networks;Optimization;Predictive models;Reliability;Training;Evolutionary Optimization;Extrusion Blow Molding;Fuzzy Logics;Genetic Algorithm;Neural Network;Surrogate Model},

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6900296&isnumber=6900223>

X. Gong, T. De Pessemier, W. Joseph and L. Martens, "A power data driven energy-cost-aware production scheduling method for sustainable manufacturing at the unit process level," *2016 IEEE 21st International Conference on Emerging Technologies and Factory Automation (ETFA)*, Berlin, 2016, pp. 1-8.

doi: 10.1109/ETFA.2016.7733716

Abstract: Nowadays, the energy price is rising. The consciousness of environmental sustainability of governments and customers has been ever increasing. Consequently, manufacturing enterprises are increasingly motivated to reduce the energy cost involved in their production activities. This paper proposes a novel production scheduling method to minimize the energy cost involved in the production at the unit process level. Compared to the emerging energy-conscious production scheduling methods, this method builds the finite state machine based energy model from power data that are measured from the shop floor. By following the formulated mixed integer linear programming model, the power states and changeovers of a unit process can be additionally scheduled, and the potential multiple process idle modes can be optimally selected between two jobs. In addition, the process power consumption behavior can be predicted along with the optimal schedule. This method was demonstrated in an extrusion blow molding process in a Belgian plastic bottle manufacturer. Compared to two conventional schedules, i.e., "as-early-as-possible" and "as-late-as-possible", the schedule given by the proposed method is able to reduce 21% and 11% of electricity cost for completing the same production task before a due date.

keywords: {extrusion;integer programming;linear programming;plastics industry;power consumption;scheduling;sustainable development;Belgian plastic bottle manufacturer;as-early-as-possible schedule;as-late-as-possible schedule;environmental sustainability;extrusion blow molding process;mixed integer linear programming;power data driven energy-cost-aware production scheduling method;process power consumption;sustainable manufacturing;unit process level;Energy consumption;Energy measurement;Job shop scheduling;Manufacturing;Monitoring;Production facilities;demand response;energy modeling;optimization;production scheduling;sustainable manufacturing},

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7733716&isnumber=7733490>

X. Liu, K. Li, M. McAfee and J. Deng, "Polymer extrusion process monitoring using nonlinear dynamic model-based PCA," *Proceedings of 2012 UKACC International Conference on Control*, Cardiff, 2012, pp. 7-12.

doi: 10.1109/CONTROL.2012.6334593

Abstract: Polymer extrusion is one of the final forming stages in the production of many polymeric products in a variety of applications. It is also an intermediate processing step in injection moulded, blown film, thermo-formed, and blow moulded products. However, polymer extrusion is a complex process which is difficult to set up, monitor, and control. As a consequence, high levels of off-specification products and long down-times are the problems facing the plastics industry. This paper proposes a new method for fault detection of the polymer extrusion processes, where the nonlinear finite impulse response (NFIR) model and principal component analysis (PCA) are integrated to form a nonlinear dynamic model-based PCA monitoring scheme. Here the NFIR model is used to capture the nonlinearity and dynamics of the extrusion process. The residuals resulting from the difference between the model predicted outputs and process outputs are then analyzed by PCA to detect process faults. The experimental results confirm the efficacy of the proposed model-based PCA approach for fault detection of polymer extrusion processes.

keywords: {FIR filters;extrusion;fault diagnosis;injection moulding;nonlinear dynamical systems;plastic products;plastics industry;polymers;principal component analysis;process monitoring;NFIR model;blow moulded products;blown film products;complex process;extrusion process dynamics;extrusion process nonlinearity;fault detection;final forming stages;injection moulded products;intermediate processing step;model predicted outputs;nonlinear dynamic model-based PCA monitoring scheme;nonlinear finite impulse response model;off-specification products;plastics industry;polymer extrusion process monitoring;polymeric products;principal component analysis;process faults;process outputs;thermo-formed products;Computational modeling;Data models;Monitoring;Nonlinear dynamical systems;Polymers;Predictive models;Principal component analysis;Principal component analysis;nonlinear dynamic model;polymer extrusion process},

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6334593&isnumber=6334591>

S. J. Dahman, "Recent innovations of inherently conducting polymers for optimal (10^6 – 10^9 OHM/SQ) ESD protection materials," *2001 Electrical Overstress/Electrostatic Discharge Symposium*, Portland, OR, 2001, pp. 253-259.

Abstract: Processability and thermal stability have historically been the two major limitations in the use of inherently conducting polymers. Recent innovations now allow the successful use of inherently conducting polymers in various thermoplastic compounds. These materials exhibit useful electrical properties suitable for optimal ESD protection. Thermoplastic compounds have been developed for injection molding, blow molding, and extrusion processing in polypropylene, polyethylene, and polystyrene. Potential applications include but are not limited to tote boxes and bins, cases, containers, blown film, strapping, or thermo formed sheet where protection from electrostatic discharge is required.

keywords: {blow moulding;conducting polymers;electrostatic discharge;extrusion;injection moulding;thermal stability;blow molding;conducting polymers;electrical properties;electrostatic discharge;extrusion processing;injection molding;optimal ESD protection material;polyethylene;polypropylene;polystyrene;thermal stability;thermo formed sheet;thermoplastic compounds;tote boxes;Conducting materials;Electrostatic discharge;Injection molding;Polyethylene;Polymers;Protection;Sheet materials;Technological innovation;Thermal conductivity;Thermal stability},

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5254963&isnumber=5254930>

J. G. Dougherty, "Power Quality Initiative: polymers processing," *1999 IEEE Annual Textile, Fiber and Film Industry Technical Conference (Cat. No.99CH37006)*, Atlanta, GA, 1999, pp. 6 pp.-.

doi: 10.1109/TEXCON.1999.766181

Abstract: The purpose of this paper is to provide an update on the Power Quality Initiative aimed at the plastics and polymers processing industry. With the goal of identifying unique power quality problems and solutions, the Electric Power Research Institute (EPRI), Duke Power Company, and other industry "players" embarked on a Power Quality Initiative in late 1997. The initiative involves equipment testing for five process types: blown thin film, plastic jacket, thick film, injection molding, and plastic pipe extrusion. CommScope Incorporated of Hickory, NC became interested in the initiative at its inception and has since then partnered with EPRI, Duke Power and the Polymers Extension Program to test their extrusion equipment, implement solutions, and has offered their case study to promote this Power Quality Initiative

keywords: {extrusion;plastics industry;polymers;power supply quality;power systems;CommScope Incorporated;Duke Power Company;Electric Power Research Institute;Polymers Extension Program;Power Quality Initiative;blown thin film processes;equipment testing;extrusion equipment testing;injection molding processes;plastic jacket processes;plastic pipe extrusion processes;plastics processing industry;polymers processing industry;power quality problems;thick film processes;Electrical equipment industry;Fuel processing industries;Manufacturing industries;Manufacturing processes;Plastics industry;Polymers;Power quality;Production;Raw materials;Testing},

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=766181&isnumber=16597>