Highlights

   DOI: 10.1631/jzus.A1500042
   **Abstract:** This article reviews recent developments in fluid power engineering, particularly its market and research in China. The development and new techniques of the pump, valve, and actuator are presented in brief with a discussion of two typical modern fluid power systems, which are the switched inertance hydraulic system and the hydraulic quadruped robot. Challenges and recommendations are given in four aspects including efficiency, compactness and integration, cleanliness, and fluid power education.

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   **Abstract:** For purposes of automating the assignment of tolerances during design, a math model, called the Tolerance-Map (T-Map), has been produced for most of the tolerance classes that are used by designers. Each T-Map is a hypothetical point-space that represents the geometric variations of a feature in its tolerance-zone. Of the six tolerance classes defined in the ASME/ANSI/ISO Standards, profile tolerances have received the least attention for representation in computer models. The objective of this paper is to describe a new method of construction, using computer-aided geometric design, which can produce the T-Map for any line-profile. The new method requires decomposing a profile into segments, creating a solid-model T-Map primitive for each, and then combining these by Boolean intersection to generate the T-Map for a complete line profile of any shape. To economize on length, the scope of this paper is limited to line-profiles formed from circular arc-segments. The parts containing the line-profile features are considered to be rigid.

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   **Abstract:** Tolerance analysis consists of analyzing the impact of variations on the mechanism behavior due to the manufacturing process. The goal is to predict its quality level at the design stage. The technique involves computing probabilities of failure of the mechanism in a mass production process. The various analysis methods have to consider the component’s variations as random variables and the worst configuration of gaps for over-constrained systems. This consideration varies in function by the type of mechanism behavior and is realized by an optimization scheme combined with a Monte Carlo simulation. To simplify the optimization step, it is necessary to linearize the mechanism behavior into several parts. This study aims at analyzing the impact of the linearization strategy on the probability of failure estimation; a highly over-constrained mechanism with two pins and five cotters is used as an illustration for this study. The purpose is to strike a balance among model error caused by the linearization, computing time,
and result accuracy. In addition, an iterative procedure is proposed for the assembly requirement to provide accurate results without using the entire Monte Carlo simulation.

Abstract: With the development of precision manufacturing, the understanding of tolerance has become a research hotspot in the field of manufacturing. An adaptable design method for understanding tolerance in the precision stamping process is proposed in this study. First, fluctuations of tolerance which are caused by differences in the stamping process are analyzed, such as differences in material and thickness, which can lead to changes in the metal flow stress curve. Second, a condition-driven adaptive design method is constructed based on a monitoring system and hydraulic control system. The mapping rules between multiple disturbance factors and the execution strategy are established by the hidden Markov model algorithm. Third, executive parameters, such as velocity, pressure, and gaps, are calculated and optimized by the data statistics of partial tolerance fluctuations in the control module. Then disturbances of various conditions could be adaptively controlled timely and effectively by the executive parameters. Finally, the adaptive design method for tolerance of one precision stamping part is applied, and the effect of the application is proved by the optimized results.

Abstract: Adsorption is one of the widely used processes in the chemical industry environmental application. As compared to mathematical models proposed to describe batch adsorption in terms of isotherm and kinetic behavior, insufficient models are available to describe and predict fixed-bed or column adsorption, though the latter one is the main option in practical application. The present review first provides a brief summary on basic concepts and mathematic models to describe the mass transfer and isotherm behavior of batch adsorption, which dominate the column adsorption behavior in nature. Afterwards, the widely used models developed to predict the breakthrough curve, i.e., the general rate models, linear driving force (LDF) model, wave propagation theory model, constant pattern model, Clark model, Thomas model, Bohart-Adams model, Yoon-Nelson model, Wang model, Wolborska model, and modified dose-response model, are briefly introduced from the mechanism and mathematical viewpoint. Their basic characteristics, including the advantages and inherit shortcomings, are also discussed. This review could help those interested in column adsorption to reasonably choose or develop an accurate and convenient model for their study and practical application.

Abstract: Much energy is stored in wastewaters. How to efficiently capture this energy is of great significance for meeting the world’s energy needs, reducing wastewater handling costs and increasing the sustainability of wastewater treatment. The microbial fuel cell (MFC) is a recently developed biotechnology for electrical energy recovery from the organic pollutants in wastewaters. MFCs hold great promise for sustainable wastewater treatment. However, at present there is still much research needed before the MFC technique can be practically applied in the real world. In this review, we analyze the opportunities and key challenges for MFCs to achieve sustainability in wastewater treatment. We especially discuss the problems and challenges for scaling up the MFC systems; this is the most critical issue for realizing the practical implementation of this technique. In order to achieve sustainability, MFCs may also be combined with other techniques to yield high effluent quality or to recover more commercial value (i.e., by producing energy-rich or high value chemicals) from wastewaters. However, research in this area is still on-going and many problems need to be settled before real-world application. Advances are required in respect of efficiency, economic feasibility, system stability, and reliability.