# Fundamentals of Enclosure Fire Zone Models

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**Abstract**
*There are two main methods in fire modellnig: zone models and field models. The conservation of mass and energy in enclosure is the theoretical base of zone models. The models deal with heat release rate, fire plume, mass flow, smoke movement and gas temperature in fires. Theoretical principles of compartment fire zone modeling are presented and the behavior of fire in enclosures is discussed.The conservation laws are presented in control volume form and applied to the behavior of fire in enclosures. The governing equations are derived and presented. Some zone models and their field of application in fire modeling are also given.*

**Keywords: Fire Modeling, Zone Model, Conservation of Mass, Conservation of Energy, Control Volume**

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# Review on Non-Invasive Ultrasonic Tomography for Gas-Liquid Flow Analyzing and Validation of CFD Simulations

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**Abstract**
*In present study non-invasive imaging and measurement of gas/liquid flow by using ultrasonic tomography as a new method for analyzing of flow pattern and phases volume fractions in industrial multiphase flow, validation of Computational Fluid Dynamics (CFD) simulations and transient phenomena has been reviewed. The limitations and application ranges of this non-invasive imaging have been introduced, although the theory of image reconstruction using this technique has been described.*

**Keywords: Tomography, Multiphase Flow, Ultrasonic, Flow Measurement System, Validation**

# Chaotic Mixing of High-Viscous Fluids Using a New Type of Continuous Mixer

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**Abstract**
*In this paper, the design, manufacturing and testing of a new type of continuous mixer for high viscous fluids are discussed. Preparation of a homogenous final product from mixing of two high viscous fluids and mixing of a powder with high viscous fluid are two major problems in food and chemical processes. This major problem is due to low diffusivity of very viscous fluids because of the presence of the macromolecules. In the present work a new type of continuous mixer based on chaotic theory for mixing of high viscous is experimentally analyzed. Results show that with increasing of rotational velocity of rotor mixing index improves and more regions of working fluid are colored by secondary fluid.*

**Keywords:** **Design and Manufacturing, Mixer, High-Viscous Fluids, Chaotic Advection**

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# Determining the Elastic Modulus of Biological Samples by AFM

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**Abstract**
*Atomic force microscopy (AFM) is capable of imaging the surface of sample, as well as obtaining the information about mechanical properties of samples such as elastic modulus. Nano indentation using the atomic force microscope makes it a powerful technique to determine elastic properties like the Young's modulus for biological samples. JPK IP software is easy procedure and suitable to obtain elastic data and calculate young modulus.*

**Keywords:** **Atomic Force Microscopy, Elastic Modulus, Nano Indentation, Biological Samples**

چکیده مقالات

# Analysis of Anaerobic Baffled Reactor (ABR) Efficiency in Wastewater Treatment

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**Abstract**

*The anaerobic baffled reactor (ABR) is a modification of up-flow anaerobic sludge blanket (UASB) reactor. In this staged reactor biomass retention is enhanced by forcing the water flow through several compartments. This reactors has several advantages such as simple design, low HRT, less sludge which over well developed than systems such as the UASB and the anaerobic filter. The literature survey shows that there are novel reactors such as MABR, PABR, SFABR, GRABBR based on ABR design concept. This review article concerning the development, applicability and possible future application of these reactors for wastewater treatment is presented.*

**Keywords:** **ABR Reactor, Wastewater Treatment, Anaerobic Treatment, Anaerobic Reactor**

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# Modeling and Multi Objective Optimization of SOFC Based On Breakeven Per Unit Electricity Cost, Efficiency and Output Power

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**Abstract**

*In the context of stationary power generation, fuel cell based systems are being predicted as a valuable option to tabernacle the thermodynamic cycle based power plants. In this paper, a thermo-economic model is developed to simulate a solid oxide fuel cell (SOFC) and optimize the stacks performance using genetic algorithm technique. Multi- objective optimization (MOO) method is presented that systematically generates the most attractive operation condition of a SOFC system. This allows performing the optimization of the system regarding to two objectives in the first problem that are minimization of the breakeven per-unit energy cost ($/kWh) and maximization of the output power. Similarly, two other objectives are also considered in the second problem as minimization of the breakeven per-unit energy cost ($/kWh) and maximization of the efficiency. Optimization of the first problem predicts a maximum power output of 78.7 kW at a breakeven per-unit energy cost of 0.56 $/kWh and minimum breakeven per-unit energy cost of 0.32 $/kWh at a power of 31.5 kW. In the second problem, maximum efficiency of 52.3% at a breakeven per-unit energy cost of 0.46 $/kWh is predicted, while minimum breakeven per-unit energy cost of 0.32 $/kWh at efficiency of 44.6% is obtained. At the end, sensitivity analyses of two problems for different fuel utilization values are presented. It is worthy to note that multi objective optimization can be considered both as an advanced analysis tool and as support to technology managers, engineers and decision makers when working by such as systems.*

**Keywords:** **Multi Objective Optimization, Solid Oxide Fuel Cell, Genetic Algorithm, Sensitivity Analysis, Fuel Utilization**

# Study of $CO_2$ Hydrate Formation Process in Saline Aquifers

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## Abstract

*Reduction of $CO_2$ emissions into atmosphere is basic concern of governments. Among different existing solutions for $CO_2$ expulsion, injection of $CO_2$ into saline aquifers has attracted much attention. These formations have a huge capacity for $CO_2$ storage, but, there are some obstacles such as hydrate formation during $CO_2$ injection. Optimization of these processes requires knowledge of phase behavior of $CO_2$, hydrocarbons, water and electrolyte systems at high pressures and temperatures. Among the current projects, only a few of them which thermodynamically and regionally have the potential of hydrate formation are probable options for investigating hydrate formation. In this paper, phase behavior of gas hydrates and available models for predicting gas hydrate formation in the presence of electrolytes have been investigated. Among these models, those which have the ability of modeling at high temperature, high pressure and high electrolyte concentration are the best options for predicting gas hydrate formation in the aquifer.*

**Keywords:** **Global Warming, Saline Aquifer, $CO_2$ Hydrate, Gas Hydrate Formation Prediction**

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# A Detailed Procedure to Fluid Recombination Process by the Focus on a Volatile Reservoir Fluid in North West of Iran

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## Abstract

*Sampling process is one of the important tasks in petroleum engineering which is used to specify the fluid type and estimate its PVT characteristics. In this study a detailed step by step procedure has been proposed. Based on the temperature and pressure conditions in each step, one or more oil or gas properties have been calculated using appropriate formula. Since the sampling from down-hole cannot provide sufficient volume for PVT analysis and other fluid calculations, the surface sampling and recombination processes is of great importance. To validate the proposed procedures, we studied a surface recombination process on a volatile reservoir fluid from an oil field in Middle East. The results indicate reasonable agreements between recombined fluid properties and reservoir fluid properties obtained from routine analysis. The error of 3.2 % has been observed in saturation pressure values compared with the down-hole reservoir fluid.*

**Keywords:** **Downhole Sampling, Wellhead Sampling, Representative Reservoir Fluid**

# Modeling of Polyethylene Therephthalate Migration in Food Packing

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**Abstract**

*In this research, polyethylene therephthalate migration from packaging materials into food is studied and an accurate model is presented for predicting of migration rate. The partial differential equations of the model are solved analytically using separation of variables method. In the modeling, the effect of various parameters including diffusion coefficient, temperature, molecular weight and time on polyethylene therephthalate migration was investigated. Also the impact of immigration on legal immigration and the thickness of packaging materials on food storage time are presented. The results showed that the thickness of the polymer should be optimized based on the type of classification emigrants, temperature and storage time. Effect of molecular packing showed that the lower molecular weight substances into the food mass transfer rate increases.*

**Keywords: Migration, Polyethylene Therephthalate, Diffusion Coefficient, Polymer Thickness, Modeling**