ferently with gas velocity and fraction of coarse particles in bubbling and turbulent fluidization regimes. As a quantitative measure for describing the complexity or the self-affine property of the time series signals, a fractal analysis was introduced and related to the hydrodynamics of the fluidized beds. A correlation to predict the transition velocity of a binary solids fluidized bed was also developed in this paper.

Effect of packed bed on mass transfer in external-loop airlift bubble column
Okada K., Nagata Y. & Akagi Y., *Journal of Chemical Engineering of Japan*, 1996, 29/4 (582-587). In English.
The influence of packed bed set in the riser section on the liquid-side volumetric mass transfer coefficient (K_La_R) in an external-loop airlift bubble column was examined with water, 20 wt% glycerol, 10 wt% ethanol and 0.3 wt% CMC aqueous solutions. Bubble size, bubble rise velocity and gas holdup in the riser were measured to examine the effect of the packed bed using an optical fiber two-phase flow system. The presence of the packed bed in the riser increased the K_La_R values for the liquids used. This was associated with the increase in the specific gas-liquid interfacial area due to bubble breakage by the packed bed. A correlation equation for K_La_R was proposed for both types of airlift bubble columns with and without the packed bed.

Predictions of gas hold-up and liquid velocity in airlift reactors using two-phase flow friction coefficients
Garcia-Calvo E. & Leton P., *Journal of Chemical Technology and Biotechnology*, 1996, 67/4 (388-396). In English.
The overall friction coefficient of airlift reactors was estimated using equivalent lengths and friction factors. The friction factor was calculated taking into account the riser liquid velocity profile corresponding to the two-phase flow and using classical one-phase equations. A previously described model was used to obtain simultaneously both gas hold-up and liquid circulation velocity. The model simulates experimental data obtained in a wide range of configurations of internal and external airlift reactors with Newtonian and non-Newtonian systems.

Computational methods for multiphase flow and reactive transport problems arising in subsurface contaminant remediation
Arbogast T., Bryant S., Dawson C., Saaf F., Chong Wang & Wheeler M., *Journal of Computational and Applied Mathematics*, 1996, 74/1-2 (19-32). In English.
A mathematical formulation and some numerical approximation techniques are described for a system of coupled partial differential and algebraic equations describing multiphase flow, transport and interactions of chemical species in the subsurface. A parallel simulator PARSIM has been developed based on these approximation techniques and is being used to study contaminant remediation strategies. Numerical results for a highly complex geochemistry problem involving strontium disposal in a pit at Oak Ridge National Laboratory are presented.

Influence of particle size, fluidization velocity and relative humidity on fluidized bed electrostatics
Guardiola J., Rojo V. & Ramos G., *Journal of Electrostatics*, 1996, 37/1-2 (1-20). In English.
The influence of particle size, fluidization velocity, and relative humidity on the degree of electrification reached by a fluidized bed of glass beads has been studied. The static electrification of the bed was measured by means of the potential difference observed between an electric probe and the metallic distributor. The effect of relative humidity appears to be complex and is connected with the quality of fluidization existing in the bed. A characteristic curve for electrification vs. humidity has been proposed that consists of five zones. When the value of the relative humidity is lower than a critical value (RH_c), the static electrification of the bed cannot be measured accurately because the adhesion of particles to the probe leads to irreproducible voltage values. The degree of electrification increases with particle size and air velocity. The relationship between the average solid circulation veocity and electrification is studied.

Interaction of single travelling bubbles with the boundary layer and attached cavitation
Chih-Yang Li & Ceccio S.L., *Journal of Fluid Mechanics*, 1996, 322/- (329-353). In English.
Individual travelling cavitation bubbles were examined as they interacted with the flow over a two-dimensional hydrofoil. Each bubble was produced from a single nucleus created upstream of the hydrofoil, and the flow near the hydrofoil was visualized using particle imaging velocimetry (PIV). Travelling bubbles were observed to generate a local region of turbulence as they passed close to an unstable laminar boundary layer. By producing a locally turbulent region, the bubbles could temporarily sweep away a portion of attached cavitation at the foil midchord. Also, the bubbles were observed to strongly interact with a turbulent boundary layer, producing local regions of patch cavitation.

On general transformations and variational principles for the magnetohydrodynamics of ideal fluids. Part 2. Stability criteria for two-dimensional flows
Vladimirov V.A., Moffatt H.K. & Ilin K.I., *Journal of Fluid Mechanics*, 1996, 329/- (187-205). In English.
The techniques developed in Part 1 of the present series are here applied to two-dimensional solutions of the equations governing the magnetohydrodynamics of ideal incompressible fluids. We first demonstrate an isomorphism between such flows and the flow of a stratified fluid subjected to a field of force that we describe as pseudo-gravitational. We then construct a general Casimir as an integral of an arbitrary function of two conserved fields, namely the vector potential of the magnetic field, and the analogous potential of the modified vorticity field.

Concentration waves and the instability of bubbly flows
Lammers J.H. & Biesheuvel A., *Journal of Fluid Mechanics*, 1996, 328/- (67-93). In English.
This paper examines whether G.K. Batchelor's (1988) theory of the propagation of planar concentration disturbances and the occurrence of instabilities in uniform fluidized beds can be applied to bubbly flows. Experi-

ments on the propagation of weak concentration shock waves and small, but finite, amplitude periodic waves are presented; good agreement is found with classic solutions of Burger's equation. Batchelor's instability conditions are given for bubbly flows, and his model for the bulk modulus of elasticity of the dispersed phase is used to obtain estimates of the critical volume concentration at which a uniform bubbly flow becomes unstable to planar disturbances. Observations of the onset of instabilities of bubbly flow in a pipe are described, and compared with what would be expected from Batchelor's theory.

On the motion of laminar wing wakes in a stratified fluid
Spalart P.R., *Journal of Fluid Mechanics,* 1996, 327/- (139-160). In English.
We present numerical solutions for two-dimensional laminar symmetric vortex systems descending in a stable stratified fluid, within the Boussinesq approximation. Three types of flows are considered: I) tight vortices; II) those deriving from an elliptical wing lift distribution; III) those deriving from a 'high-lift' distribution, with a part-span flap on the wing. The descent velocity increases exponentially with time, as the distance between vortices decreases and the circulation of the vortices proper is conserved. With moderate stratification, wakes with sufficient energy also attain the accelerating regime, until the vortex cores make contact. However, they first experience a rebound, which is both of practical importance and out of reach of simple formulas. Type III wakes produce two durable vortex pairs which tumble, and mitigate the buoyancy effect by exchanging fluid with the surroundings.

High-frequency acoustic noise emission excited by laser-driven cavitation
Likhterov L., *Journal of Fluid Mechanics,* 1996, 318/- (77-84). In English.
A high-frequency part of the acoustic noise spectrum excited by laser-driven cavitation in liquid is investigated theoretically. It is assumed that the liquid is inviscid and compressible and the surface tension may be neglected. The specific heat ratio is taken to be 5/3. It is shown that, in the first approximation, the spectral density of the acoustic energy emitted by a cavity explosion varies as the -4/7 power of the frequency and asymptotically decreases by ~ 3.4 dB/octave.

Stability of stratified flow of large depth over finite-amplitude topography
Prasad D., Ramirez J. & Akylas T.R., *Journal of Fluid Mechanics,* 1996, 320/- (369-394). In English.
The flow of a Boussinesq density-stratified fluid of large depth past the algebraic mountain ('Witch of Agnesi') is studied in the hydrostatic limit using the asymptotic theory of Kantzios and Akylas (1993). The upstream conditions are those of constant velocity and Brunt-Vaisala frequency. On the further assumptions that the flow is steady and there is no permanent alteration of the upstream flow conditions (no upstream influence), Long's model (1953) predicts a critical amplitude of the mountain above which local density inversions occur, leading to convective overturning.

The stability of two-phase flow over a swept wing
Coward A.V. & Hall P., *Journal of Fluid Mechanics,* 1996, 329/- (247-273). In English.
We use numerical and asymptotic techniques to study the stability of a two-phase air/water flow above a flat porous plate. This flow is a model of the boundary layer which forms on a yawed cylinder and can be used as a useful approximation to the air flow over swept wings. We also investigate the instability of inviscid stationary modes. We calculate the effective wavenumber and orientation of the stationary disturbance when the fluids have identical physical properties. Using pertubation methods we obtain corrections due to a small stratification in viscosity, thus quantifying the interfacial effects. Our analytical results are in agreement with the numerical solution which we obtain for arbitrary fluid properties.

Experiments on density-gradient anisotropies and scalar dissipation of turbulence in a stably stratified fluid
Thoroddsen S.T. & Van Atta C.W., *Journal of Fluid Mechanics,* 1996, 322/- (383-409). In English.
The anisotropic behaviour of density-gradient fluctuations in stably stratified grid turbulence and the consequences for simplified (isotropic) estimates of scalar dissipation rates χ were experimentally studied in a thermally stratified wind tunnel at moderate Reynolds numbers (Re_λ 20). The correlation method was used to estimate the mean-square cross-stream and streamwise density gradients. Cross-stream gradients were measured using two cold wires. Gradient spectral relations show that this buoyancy-induced anisotropy persists at all length scales. Better closure of the scalar variance balance was attained than in previously reported measurements by other researchers. This is attributed to our use of cold-wire temperature sensors having larger length-to-diameter ratio then used in the previous measurements.

Fluid-structure interaction and cavitation in a single-elbow pipe system
Tijsseling A.S., Vardy A.E. & Fan D., *Journal of Fluids and Structures,* 1996, 10/4 (395-420). In English.
The simultaneous occurrence of fluid-structure interaction (FSI) and vaporous cavitation in the transient vibration of freely suspended horizontal pipe systems is investigated by numerical simulation and physical experiment. Extended waterhammer and beam equations, including the relevant FSI mechanisms, are solved by the method of characteristics. Column separation and cavitation are accounted for by a lumped parameter model.

Localized convection in rotating stratified fluid
Whitehead J.A., Marshall J. & Hufford G.E., *Journal of Geophysical Research,* 1996, 101/C11 (25705-25721). In English.
The convective overturning of a rotating stratified fluid is studied in the laboratory. The experiments are motivated by physical scaling arguments which attempt to predict the length and velocity scales of the convective chimney as it adjusts under gravity and rotation and breaks up through baroclinic instability. In this idealized problem the depth of penetration is found to depend only on the size and strength of the forcing and the