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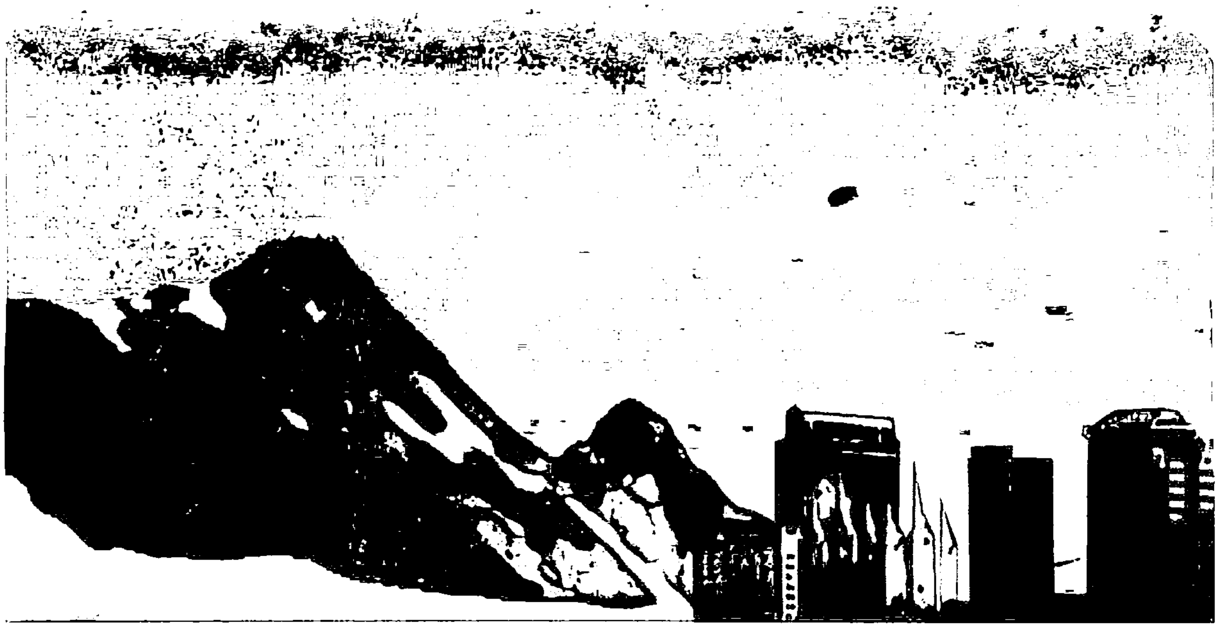

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APS physics

scale approach by solving a lattice Boltzmann equation. Specific implementation issues will be discussed. The two methods yield almost identical flows. Preliminary simulation results as well as parallel experimental results on colloid deposition in the porous channel will also be presented.

*Supported by USDA

9:35

AQ 6 Numerical Simulation of the behavior and mobilization of fine-grained quartz particles in porous media MICHAL HRADISKY, *Utah State University* JEFFREY ALLEN, *The United States Army Corps of Engineers* THOMAS HAUSER, *Utah State University* The presentation focuses on the simulation of mobilization, deposition and detachment of fine-grained, quartz particles (hereafter referred to as "fines") to silica grains. Colloidal and hydrodynamic forces are computed and evaluated. In addition, the effects of differing levels of alkalinity and electrolyte concentration are evaluated per the Happel's model and the Derjaguin-Landau and Verwey-Overbeek (DLVO) theory. This theory allows for the initial attachment of the fine particle to the surface of a silica grain, by assuming that the electrolyte concentrations of the fluid medium are sufficiently high to warrant the domination of the attractive Van der Waal's forces. Multi-grained three dimensional simulation results for a centered cubic packing structure are presented.

9:48

AQ 7 A model for ion transport during drying of a porous medium LAURA GUGLIELMINI, ALEXANDRE GONTCHAROV, *SEAS, Harvard University* ANTONIO ALDYKIEWICZ, *Grace Construction Products* HOWARD STONE, *SEAS, Harvard University* Salt crystallization at the surface or in the body of a porous medium has been recognized as a major mechanism in the deterioration of construction materials and historical monuments. Crystal formations on the surface of bricks, concrete, stones, called efflorescences, lead to fast obsolescence of building and monuments finishing, while crystal growth inside the material, called subflorescences, causes crack formation, which may lead to major structural damages. A number of studies have been devoted to the analysis of crystal growth in an elementary pore and aim at explaining the stress generated by crystallization. From a fluid mechanical point of view the physics of water transport and salt distribution in the porous medium turns out to be quite complex, since it is a function of the pore structure and wettability characteristics, of granule size and of the thermal properties of the material. It also depends on the transient environmental conditions the surface is exposed to and on the effective diffusivity of salt at different saturation conditions. We present here a simple theoretical model of the first phase of the drying process, during which water is uniformly distributed throughout the medium and often efflorescences occurs, which aims at characterizing the physics involved in the process.

10:01

AQ 8 Vibration effect on a stability of a displacement front TATYANA LYUBIMOVA, *Institute of Continuous Media Mechanics UB RAS* DMITRIY LYUBIMOV, GRIGORIY SEDELNIKOV, *Perm State University* Vibration effect on the stability of the displacement front between two immiscible fluids saturating porous medium is studied. Vibrations are orthogonal to the displacement front. Darcy model is implemented for the description of filtration. For high frequency vibrations it is shown in the framework of average approach that the vibrations make stabilizing effect. For finite-frequency vibrations the parametric instability zones are determined; it is found that both stabilization and destabilization of the displacement front are possible. For finite-amplitude perturbations numerical investigation based on unsteady non-linear equations is carried out by level set method for water-oil system saturating loamy soil. Temporal evolution of the displacement front shape is studied for various initial perturbations, vibration intensities and the displacement front motion velocity. The dependence of the time needed for the formation of isolated domains on the vibration intensity is obtained. It is found that the vibrations lead to the significant growth of perturbation wavelength and characteristic time scale of perturbation growth.

SESSION AR: VORTEX DYNAMICS AND 3D VORTEX FLOWS I

Sunday morning, 18 November 2007; 251 F Salt Palace Convention Center at 8:30; Paul Krueger, Southern Methodist University, presiding

8:30

AR 1 Nonlinear stability of a swirling jet interacting with a solid wall* JOAQUIN ORTEGA-CASANOVA, RAMON FERNANDEZ-FERIA, *University of Malaga (Spain)* We consider in this work the nonlinear stability of a q-vortex interacting with a solid surface perpendicular to its axis at moderately high Reynolds numbers. We use a direct numerical simulation based on a potential vector formulation with a Fourier decomposition in N azimuthal modes. This method is specially suited for the study of the nonlinear stability of axially symmetric flows because one may follow the raising of the different non-axisymmetric modes from just numerical noise, their nonlinear development, and their nonlinear interaction. For a given Reynolds number we find that there exists different transitions as the swirl number is raised, including the development of non-axisymmetric instabilities for different azimuthal modes, their mutual nonlinear interaction, and the formation of a vortex breakdown bubble that turns the flow almost axisymmetric again. We compare these transitions with those appearing in the same flow in absence of the solid wall, and discuss the relevance of the results in the context of seabed excavation processes.

*Supported by the European Commission, Grant No. COOP-CT-2005-017725.

8:43

AR 2 Destabilization of a stretched vortex PHILIPPE PETITJEANS, *PMMH UMR CNRS 7636 Ecole Superieure de Physique et Chimie Industrielles* JORI RUPPERT-FELSOT, *LMD UMR CNRS 8539 Ecole Normale Superieure* THOMAS GOOSSENS, *PMMH UMR CNRS 7636 Ecole Superieure de Physique et Chimie Industrielles* This work focuses on the experimental study of the bursting of a stretched vortex [Y. Cuypers et al., J. Turb. **7**, N7 (2006)]. The vortex is initiated by a step in a laminar channel flow and is intensified by axial suction through two holes in the lateral wall of the channel. We observe the bursting with much higher time resolution than before possible with the use of a high speed camera operating up to 1000 frames per second. We use both dye injection, visualizing the 3D structure of the vortex, and PIV measurements, in a plane perpendicular to the axis of the