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Applied Contaminant Transport Modeling Chunmiao Zheng 2002-02-05 The challenges facing groundwater scientists and engineers today demand expertise in a wide variety of disciplines–geology, hydraulics, geochemistry, geophysics, and biology. As the number of the subdisciplines has increased and as each has become more complex and quantitative, the problem of integrating their concepts and contributions into a coherent overall interpretation has become progressively more difficult. To an increasing degree transport simulation has emerged as an answer to this problem, and the transport model has become a vehicle for integrating the vast amount of field data from a variety of sources and for understanding the relationship of various physical, chemical, and biological processes. Applied Contaminant Transport Modeling is the first

resource designed to provide coverage of the discipline's basic principles, including the theories behind solute transport in groundwater, common numerical techniques for solving transport equations, and step-by-step guidance on the development and use of field-scale modeling. The Second Edition incorporates recent advances in contaminant transport theory and simulation techniques, adding the following to the original text: -An expanded discussion of the role of aquifer heterogeneity in controlling solute transport -A new section on the dual-domain mass transfer approach as an alternative to the classical advection-dispersion model -Additional chemical processes and reactions in the discussion of reactive transport -A discussion of the TVD (total-variation-diminishing) approach to transport solution -An entirely new Part III containing two chapters on simulation of flow and transport under variable water density and under variable saturation, respectively, and a third chapter on the use of the simulation-optimization approach in remediation system design Applied Contaminant Transport Modeling, Second Edition remains the premier reference for practicing hydrogeologists, environmental scientists, engineers, and graduate students in the field. In 1998, in recognition of their work on the first edition, the authors were honored with the John Hem Excellence in Science and Engineering Award of the National Ground Water Association

Handbook of Metal-Microbe Interactions and Bioremediation Surajit Das 2017-04-07 Around the World, metal pollution is a major problem. Conventional practices of toxic metal removal can be ineffective and/or expensive, delaying and exacerbating the crisis. Those communities dealing with contamination must be aware of the fundamentals advances of microbe-mediated metal removal practices because these methods can be easily used and require less remedial intervention. This book describes innovations and efficient applications for metal bioremediation for environments polluted by metal contaminates.

The Individual Microbe: Single-Cell Analysis and Agent-Based Modelling Johan H. J. Leveau 2019-02-19 Recent technological advances in single-cell microbiology, using flow cytometry, microfluidics, x-ray fluorescence microprobes, and single-cell -omics, allow for the observation of individuals within populations. Simultaneously, individual-based models (or more generally agent-based models) allow for individual microbes to be simulated. Bridging these techniques forms the foundation of individual-based ecology of microbes (µIBE). µIBE has elucidated genetic and phenotypic heterogeneity that has important consequences for a number of human

interests, including antibiotic or biocide resistance, the productivity and stability of industrial fermentations, the efficacy of food preservatives, and the potential of pathogens to cause disease. Individual-based models can help us to understand how these sets of traits of individual microbes influence the above. This eBook compiles all publications from a recent Research Topic in Frontiers in Microbiology. It features recent research where individual observational and/or modelling techniques are applied to gain unique insights into the ecology of microorganisms. The Research Topic "The Individual Microbe: Single-Cell Analysis and Agent-Based Modelling" arose from the 2016 @ASM conference of the same name hosted by the American Society for Microbiology at its headquarters in Washington, D.C. We are grateful to ASM for funding and hosting this conference.

Radionuclide Behaviour in the Natural Environment Christophe Poinssot 2012-09-20 Understanding radionuclide behaviour in the natural environment is essential to the sustainable development of the nuclear industry and key to assessing potential environmental risks reliably. Minimising those risks is essential to enhancing public confidence in nuclear technology. Scientific knowledge in this field has developed greatly over the last decade.Radionuclide behaviour in the natural environment provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration. After an introductory chapter, part one explores radionuclide chemistry in the natural environment, including aquatic chemistry and the impact of natural organic matter and microorganisms. Part two discusses the migration and radioecological behavior of radionuclides. Topics include hydrogeology, sorption and colloidal reactions as well as in-situ investigations. Principles of modelling coupled geochemical, transport and radioecological properties are also discussed. Part three covers application issues: assessment of radionuclide behaviour in contaminated sites, taking Chernobyl as an example, estimation of radiological exposure to the population, performance assessment considerations related to deep geological repositories, and remediation concepts for contaminated sites. With its distinguished editors and international team of expert contributors, Radionuclide behaviour in the natural environment is an essential tool for all those interested or involved in nuclear energy, from researchers, designers and industrial operators to environmental scientists. It also provides a comprehensive guide for academics of all levels in this field. Provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration Explores radionuclide chemistry in the natural environment Discusses the migration and

radioecological behaviour of radionuclides

The Role of Natural and Constructed Wetlands in Nutrient Cycling and Retention on the Landscape Jan Vymazal 2014-09-26 Natural and constructed wetlands play a very important role on the landscape and their ecological services are highly valuable. In fact, some wetland types are regarded as one of the most valuable ecosystems on the Earth. Water management, including flood water retention, biomass production, carbon sequestration, wastewater treatment and biodiversity sources, are among the most important ecological services of wetlands. The book is aimed at the use of constructed wetlands for wastewater treatment and for the evaluation of various ecosystem services of natural wetlands. Special attention is paid to the role and potential use of wetlands on the agricultural landscape. The book presents up-to-date results of ongoing research and the content of the book could be used by wetland scientists, researchers, engineers, designers, regulators, decision-makers, universities teachers, landscape engineers and landscape planners as well as by water authorities, water regulatory offices or wastewater treatment research institutions.

Pore Scale Geochemical Processes Carl Steefel 2015-09-25 This RiMG (Reviews in Mineralogy & Geochemistry) volume includes contributions that review experimental, characterization, and modeling advances in our understanding of pore-scale geochemical processes. The volume had its origins in a special theme session at the 2015 Goldschmidt Conference in Prague. From a diversity of pore-scale topics that ranged from multi-scale characterization to modeling, this work summarizes the state-of-the-science in this subject. Topics include: modification of thermodynamics and kinetics in small pores. chemo-mechanical processes and how they affect porosity evolution in geological media. small angle neutron scattering (SANS) techniques. how isotopic gradients across fluid–mineral boundaries can develop and how these provide insight into pore-scale processes. Information on an important class of models referred to as "pore network" and much more. The material in this book is accessible for graduate students, researchers, and professionals in the earth, material, environmental, hydrological, and biological sciences. The pore scale is readily recognizable to geochemists, and yet in the past it has not received a great deal of attention as a distinct scale or environment that is associated with its own set of questions and challenges. Is the pore scale merely an environment in which smaller scale (molecular) processes aggregate, or are there emergent phenomena unique to this scale? Is it simply a finer-grained version

of the "continuum" scale that is addressed in larger-scale models and interpretations? The scale is important because it accounts for the pore architecture within which such diverse processes as multi-mineral reaction networks, microbial community interaction, and transport play out, giving rise to new geochemical behavior that might not be understood or predicted by considering smaller or larger scales alone.

Mineral Solubility and Free Energy Controls on Microbial Reaction Kinetics 2016 Recent developments in the theoretical treatment of geomicrobial reaction processes have resulted in the formulation of kinetic models that directly link the rates of microbial respiration and growth to the corresponding thermodynamic driving forces. The overall objective of this project was to verify and calibrate these kinetic models for the microbial reduction of uranium(VI) in geochemical conditions that mimic as much as possible field conditions. The approach combined modeling of bacterial processes using new bioenergetic rate laws, laboratory experiments to determine the bioavailability of uranium during uranium bioreduction, evaluation of microbial growth yield under energy-limited conditions using bioreactor experiments, competition experiments between metabolic processes in environmentally relevant conditions, and model applications at the field scale. The new kinetic descriptions of microbial U(VI) and Fe(III) reduction should replace those currently used in reactive transport models that couple catabolic energy generation and growth of microbial populations to the rates of biogeochemical redox processes. The above work was carried out in collaboration between the groups of Taillefert (batch reactor experiments and reaction modeling) at Georgia Tech and Van Cappellen (retentostat experiments and reactive transport modeling) at University of Waterloo (Canada).

Reactive transport modeling of fluid-rock interactions associated with carbonate diagenesis and implications for reservoir quality prediction Ying Xiong 2022-07-26 Diagenesis research is the foundation of hydrocarbon reservoir characterization and exploration. Reactive transport modeling (RTM) is an emerging approach for diagenesis research, with unique capability of quantification and forward modeling of the coupled thermo-hydro-chemical processes of diagenesis. Using TOUGHREACT simulator, this thesis investigates the two most important fluid-rock interactions in carbonate rocks, i.e., dolomitization and karstification, based on generic model analyses and a case study in the Ordos Basin, China. In particular, this study attempts to quantitatively characterize the diagenetic processes and to reconstruct the diagenesis-porosity evolution of carbonate

reservoirs. Some controversies in carbonate diagenesis research, which cannot be well explained by classical geological methods, have also been discussed. The results are helpful to better understand the spatial-temporal distribution and co-evolution of diagenesis-mineral-porosity during the complicated diagenetic processes with their potential controlling factors, and to reduce the uncertainty of reservoir quality prediction.

Coupled Modeling of Groundwater Flow Solute Transport, Chemical Reactions and Microbial Processes in the 'SP' Island Guoxiang Zhang 2003 The Redox Zone Experiment was carried out at the Aespoe HRL in order to study the redox behavior and the hydrochemistry of an isolated vertical fracture zone disturbed by the excavation of an access tunnel. Overall results and interpretation of the Redox Zone Project were reported by /Banwart et al, 1995/. Later, /Banwart et al, 1999/ presented a summary of the hydrochemistry of the Redox Zone Experiment. Coupled groundwater flow and reactive transport models of this experiment were carried out by /Molinero, 2000/ who proposed a revised conceptual model for the hydrogeology of the Redox Zone Experiment which could explain simultaneously measured drawdown and salinity data. The numerical model was found useful to understand the natural system. Several conclusions were drawn about the redox conditions of recharge waters, cation exchange capacity of the fracture zone and the role of mineral phases such as pyrite, calcite, hematite and goethite. This model could reproduce the measured trends of dissolved species, except for bicarbonate and sulfate which are affected by microbially-mediated processes. In order to explore the role of microbial processes, a coupled numerical model has been constructed which accounts for water flow, reactive transport and microbial processes. The results of this model is presented in this report. This model accounts for groundwater flow and reactive transport in a manner similar to that of /Molinero, 2000/ and extends the preliminary microbial model of /Zhang, 2001/ by accounting for microbially-driven organic matter fermentation and organic matter oxidation. This updated microbial model considers simultaneously the fermentation of particulate organic matter by yeast and the oxidation of dissolved organic matter, a product of fermentation. Dissolved organic matter is produced by yeast and serves also as a substrate for iron-reducing bacteria. Model results reproduce the observed increase in bicarbonate and sulfate concentration, thus adding additional evidence for the possibility of organic matter oxidation as the main source of bicarbonate. Model results indicate that pH and Eh are relatively stable. The dissolution-precipitation trends of hematite, pyrite and calcite also

coincide with those indicated by the conceptual model. A thorough sensitivity analysis has been performed for the most relevant microbial parameters as well as for initial and boundary POC and DOC concentrations. The results of such analysis indicate that computed concentrations of bicarbonate, sulfate and DOC are sensitive to most of the microbial parameters, including specific growth rates, half-saturation constants, proportionality coefficients and yield coefficients. Model results, however, are less sensitive to the yield coefficient of DOC to iron-reducer bacteria. The sensitivity analysis indicates that changes in fermentation microbial parameters affect the growth of the iron-reducer, thus confirming the interconnection of both microbial processes. Computed concentrations of bicarbonate and sulfate are found to be sensitive to changes in the initial concentration of POC and the boundary concentration of DOC, but they lack sensitivity to the initial concentration of DOC and the boundary concentration of POC. The explanation for such result is related to the fact that POC has a low mobility due to its large molecular weight. DOC, however, can migrate downwards. Although a coupled hydro-bio-geochemical 1-D model can reproduce the observed "unexpected" increase of concentrations of bicarbonate and sulfate at a depth of 70 m, further modeling work is required in order to obtain a similar conclusion under the more realistic two dimensional conditions of the fracture zone.

Distributed Hydrological Modelling Michael B. Abbott 2012-12-06 It is the task of the engineer, as of any other professional person, to do everything that is reasonably possible to analyse the difficulties with which his or her client is confronted, and on this basis to design solutions and implement these in practice. The distributed hydrological model is, correspondingly, the means for doing everything that is reasonably possible - of mobilising as much data and testing it with as much knowledge as is economically feasible - for the purpose of analysing problems and of designing and implementing remedial measures in the case of difficulties arising within the hydrological cycle. Thus the aim of distributed hydrologic modelling is to make the fullest use of cartographic data, of geological data, of satellite data, of stream discharge measurements, of borehole data, of observations of crops and other vegetation, of historical records of floods and droughts, and indeed of everything else that has ever been recorded or remembered, and then to apply to this everything that is known about meteorology, plant physiology, soil physics, hydrogeology, sediment transport and everything else that is relevant within this context. Of course, no matter how much data we have and no matter how much we know, it will never be enough

to treat some problems and some situations, but still we can aim in this way to do the best that we possibly can.
Reactive Transport in Soil and Groundwater Gunnar Nützmann 2006-02-08 In this book, the authors focus on the improvement of the scientific base for the development of environmental risk indicators measured by the presence of pollutants in water and porous media. In pursuit of a correct and complete numerical approach, they deliver insight into the understanding of integrated process, and also of modeling capabilities.
Computational Models for CO2 Geo-sequestration & Compressed Air Energy Storage Rafid Al-Khoury 2014-04-17 A comprehensive mathematical and computational modeling of CO2 Geosequestration and Compressed Air Energy StorageEnergy and environment are two interrelated issues of great concern to modern civilization. As the world population will soon reach eight billion, the demand for energy will dramatically increase, intensifying the use of fossil fuels. Ut
Reactive Transport in Porous Media Peter C. Lichtner 2018-12-17 Volume 34 of Reviews in Mineralogy focuses on methods to describe the extent and consequences of reactive flow and transport in natural subsurface systems. Since the field of reactive transport within the Earth Sciences is a highly multidisciplinary area of research, including geochemistry, geology, physics, chemistry, hydrology, and engineering, this book is an attempt to some extent bridge the gap between these different disciplines. This volume contains the contributions presented at a short course held in Golden, Colorado, October 25-27, 1996 in conjunction with the Mineralogical Society of America's (MSA) Annual Meeting with the Geological Society of America in Denver, Colorado.
Reactive Transport in Natural and Engineered Systems Jennifer Druhan 2020-03-04 Open system behavior is predicated on a fundamental relationship between the timescale over which mass is transported and the timescale over which it is chemically transformed. This relationship describes the basis for the multidisciplinary field of reactive transport (RT). In the 20 years since publication of Review in Mineralogy and Geochemistry volume 34: Reactive Transport in Porous Media, RT principles have expanded beyond early applications largely based in contaminant hydrology to become broadly utilized throughout the Earth Sciences. RT is now employed to address a wide variety of natural and engineered systems across diverse spatial and temporal scales, in tandem with advances in computational capability, quantitative imaging and reactive interface characterization

techniques. The present volume reviews the diversity of reactive transport applications developed over the past 20 years, ranging from the understanding of basic processes at the nano- to micrometer scale to the prediction of Earth global cycling processes at the watershed scale. Key areas of RT development are highlighted to continue advancing our capabilities to predict mass and energy transfer in natural and engineered systems.

Selected Water Resources Abstracts 1989

BIOMOC, a Multispecies Solute-transport Model with Biodegradation Hedeff I. Essaid 1997

Contaminants in the Subsurface National Research Council 2005-03-23 At hundreds of thousands of commercial, industrial, and military sites across the country, subsurface materials including groundwater are contaminated with chemical waste. The last decade has seen growing interest in using aggressive source remediation technologies to remove contaminants from the subsurface, but there is limited understanding of (1) the effectiveness of these technologies and (2) the overall effect of mass removal on groundwater quality. This report reviews the suite of technologies available for source remediation and their ability to reach a variety of cleanup goals, from meeting regulatory standards for groundwater to reducing costs. The report proposes elements of a protocol for accomplishing source remediation that should enable project managers to decide whether and how to pursue source remediation at their sites.

The Reactive Transport of Suspended Particles Richard Steven Mercier 1985

Groundwater Geochemistry Broder J. Merkel 2008-05-30 To understand hydrochemistry and to analyze natural as well as man-made impacts on aquatic systems, hydrogeochemical models have been used since the 1960's and more frequently in recent times. Numerical groundwater flow, transport, and geochemical models are important tools besides classical deterministic and analytical approaches. Solving complex linear or non-linear systems of equations, commonly with hundreds of unknown parameters, is a routine task for a PC. Modeling hydrogeochemical processes requires a detailed and accurate water analysis, as well as thermodynamic and kinetic data as input. Thermodynamic data, such as complex formation constants and solubility-products, are often provided as databases within the respective programs. However, the description of surface-controlled reactions (sorption, cation exchange, surface complexation) and kinetically controlled reactions requires additional input data. Unlike groundwater flow and transport models, thermodynamic models, in principal, do not

need any calibration. However, considering surface-controlled or kinetically controlled reaction models might be subject to calibration. Typical problems for the application of geochemical models are: • speciation • determination of saturation indices • adjustment of equilibria/disequilibria for minerals or gases • mixing of different waters • modeling the effects of temperature • stoichiometric reactions (e.g. titration) • reactions with solids, fluids, and gaseous phases (in open and closed systems) • sorption (cation exchange, surface complexation) • inverse modeling • kinetically controlled reactions • reactive transport Hydrogeochemical models depend on the quality of the chemical analysis, the boundary conditions presumed by the program, theoretical concepts (e.g.

Microbial Biodegradation and Bioremediation Surajit Das 2014-07-01 Microbial Biodegradation and Bioremediation brings together experts in relevant fields to describe the successful application of microbes and their derivatives for bioremediation of potentially toxic and relatively novel compounds. This single-source reference encompasses all categories of pollutants and their applications in a convenient, comprehensive package. Our natural biodiversity and environment is in danger due to the release of continuously emerging potential pollutants by anthropogenic activities. Though many attempts have been made to eradicate and remediate these noxious elements, every day thousands of xenobiotics of relatively new entities emerge, thus worsening the situation. Primitive microorganisms are highly adaptable to toxic environments, and can reduce the load of toxic elements by their successful transformation and remediation. Describes many novel approaches of microbial bioremediation including genetic engineering, metagenomics, microbial fuel cell technology, biosurfactants and biofilm-based bioremediation Introduces relatively new hazardous elements and their bioremediation practices including oil spills, military waste water, greenhouse gases, polythene wastes, and more Provides the most advanced techniques in the field of bioremediation, including insilico approach, microbes as pollution indicators, use of bioreactors, techniques of pollution monitoring, and more

Wastewater Re-use and Groundwater Quality J. H. A. M. Steenvoorden 2004

On Some Problems in the Simulation of Flow and Transport Through Porous Media Sunil George Thomas 2009 The dynamic solution of multiphase flow through porous media is of special interest to several fields of science and engineering, such as petroleum, geology and geophysics, bio-medical, civil and environmental, chemical

engineering and many other disciplines. A natural application is the modeling of the flow of two immiscible fluids (phases) in a reservoir. Others, that are broadly based and considered in this work include the hydrodynamic dispersion (as in reactive transport) of a solute or tracer chemical through a fluid phase. Reservoir properties like permeability and porosity greatly influence the flow of these phases. Often, these vary across several orders of magnitude and can be discontinuous functions. Furthermore, they are generally not known to a desired level of accuracy or detail and special inverse problems need to be solved in order to obtain their estimates. Based on the physics dominating a given sub-region of the porous medium, numerical solutions to such flow problems may require different discretization schemes or different governing equations in adjacent regions. The need to couple solutions to such schemes gives rise to challenging domain decomposition problems. Finally, on an application level, present day environment concerns have resulted in a widespread increase in CO2 capture and storage experiments across the globe. This presents a huge modeling challenge for the future. This research work is divided into sections that aim to study various inter-connected problems that are of significance in sub-surface porous media applications. The first section studies an application of mortar (as well as nonmortar, i.e., enhanced velocity) mixed finite element methods (MMFEM and EV-MFEM) to problems in porous media flow. The mortar spaces are first used to develop a multiscale approach for parabolic problems in porous media applications. The implementation of the mortar mixed method is presented for two-phase immiscible flow and some a priori error estimates are then derived for the case of slightly compressible single-phase Darcy flow. Following this, the problem of modeling flow coupled to reactive transport is studied. Applications of such problems include modeling bio-remediation of oil spills and other subsurface hazardous wastes, angiogenesis in the transition of tumors from a dormant to a malignant state, contaminant transport in groundwater flow and acid injection around well bores to increase the permeability of the surrounding rock. Several numerical results are presented that demonstrate the efficiency of the method when compared to traditional approaches. The section following this examines (non-mortar) enhanced velocity finite element methods for solving multiphase flow coupled to species transport on non-matching multiblock grids. The results from this section indicate that this is the recommended method of choice for such problems. Next, a mortar finite element method is formulated and implemented that extends the scope of the classical mortar mixed finite element method developed by Arbogast

et al (12) for elliptic problems and Girault et al (62) for coupling different numerical discretization schemes. Some significant areas of application include the coupling of pore-scale network models with the classical continuum models for steady single-phase Darcy flow as well as the coupling of different numerical methods such as discontinuous Galerkin and mixed finite element methods in different sub-domains for the case of single phase flow (21, 109). These hold promise for applications where a high level of detail and accuracy is desired in one part of the domain (often associated with very small length scales as in pore-scale network models) and a much lower level of detail at other parts of the domain (at much larger length scales). Examples include modeling of the flow around well bores or through faulted reservoirs. The next section presents a parallel stochastic approximation method (68, 76) applied to inverse modeling and gives several promising results that address the problem of uncertainty associated with the parameters governing multiphase flow partial differential equations. For example, medium properties such as absolute permeability and porosity greatly influence the flow behavior, but are rarely known to even a reasonable level of accuracy and are very often upscaled to large areas or volumes based on seismic measurements at discrete points. The results in this section show that by using a few measurements of the primary unknowns in multiphase flow such as fluid pressures and concentrations as well as well-log data, one can define an objective function of the medium properties to be determined, which is then minimized to determine the properties using (as in this case) a stochastic analog of Newton's method. The last section is devoted to a significant and current application area. It presents a parallel and efficient iteratively coupled implicit pressure, explicit concentration formulation (IMPEC) (52-54) for non-isothermal compositional flow problems. The goal is to perform predictive modeling simulations for CO2 sequestration experiments. While the sections presented in this work cover a broad range of topics they are actually tied to each other and serve to achieve the unifying, ultimate goal of developing a complete and robust reservoir simulator. The major results of this work, particularly in the application of MMFEM and EV-MFEM to multiphysics couplings of multiphase flow and transport as well as in the modeling of EOS non-isothermal compositional flow applied to CO2 sequestration, suggest that multiblock/multimodel methods applied in a robust parallel computational framework is invaluable when attempting to solve problems as described in Chapter 7. As an example, one may consider a closed loop control system for managing oil production or CO2 sequestration experiments in huge formations

(the "instrumented oil field"). Most of the computationally costly activity occurs around a few wells. Thus one has to be able to seamlessly connect the above components while running many forward simulations on parallel clusters in a multiblock and multimodel setting where most domains employ an isothermal single-phase flow model except a few around well bores that employ, say, a non-isothermal compositional model. Simultaneously, cheap and efficient stochastic methods as in Chapter 8, may be used to generate history matches of well and/or sensor-measured solution data, to arrive at better estimates of the medium properties on the fly. This is obviously beyond the scope of the current work but represents the over-arching goal of this research.

Carbonates—Advances in Research and Application: 2012 Edition 2012-12-26 Carbonates—Advances in Research and Application: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Carbonates. The editors have built Carbonates—Advances in Research and Application: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Carbonates in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Carbonates—Advances in Research and Application: 2012 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Microbial Community Modeling: Prediction of Microbial Interactions and Community Dynamics Hyun-Seob Song 2018-07-04 This book is a printed edition of the Special Issue "Microbial Community Modeling: Prediction of Microbial Interactions and Community Dynamics" that was published in Processes

Water-Rock Interaction, Two Volume Set Richard B. Wanty 2004-09-02 The interaction of the lithosphere and hydrosphere sets the boundary conditions for life, as water and the nutrients extracted from rocks are essential to all known life-forms. Water-rock interaction also affects the fate and transport of pollutants, mediates the long-term cycling of fluids and metals in the earth's crust, impacts the migration and

Groundwater Reactive Transport Models Fan Zhang 2012 Ground water reactive transport models are useful to

assess and quantify contaminant precipitation, absorption and migration in subsurface media. Many ground water reactive transport models available today are characterized by varying complexities, strengths, and weaknesses. Selecting accurate, efficient models can be a challenging task. This ebook addresses the needs, issues and challenges relevant to selecting a ground water reactive transport model to evaluate natural attenuation and alternative remediation schemes. It should serve as a handy guide for water resource managers seeking to ach.

The metabolic pathways and environmental controls of hydrocarbon biodegradation in marine ecosystems Joel E. Kostka 2015-05-15 Biodegradation mediated by indigenous microbial communities is the ultimate fate of the majority of oil hydrocarbon that enters the marine environment. The aim of this Research Topic is to highlight recent advances in our knowledge of the pathways and controls of microbially-catalyzed hydrocarbon degradation in marine ecosystems, with emphasis on the response of microbial communities to the Deepwater Horizon oil spill in the Gulf of Mexico. In this Research Topic, we encouraged original research and reviews on the ecology of hydrocarbon-degrading bacteria, the rates and mechanisms of biodegradation, and the bioremediation of discharged oil under situ as well as near in situ conditions.

Numerical and Analytical Modeling of Gas Mixing and Bio-Reactive Transport during Underground Hydrogen Storage Birger Hagemann 2018-01-11 In this thesis the major differences between underground hydrogen storage and the conventional storage of natural gas are lined out to be bio-reactive and gas mixing phenomena. A new mathematical model was developed to describe the coupling between two-phase flow and microbial populations which consume hydrogen for their metabolism. Different analytical and numerical techniques were applied to investigate the storage of hydrogen in the geological subsurface. An analytical solution was derived for gravity-driven multi-component two-phase flow in heterogeneous porous media. Oscillating scenarios, similar to Turing instability, were detected. Storage scenarios were simulated including a field scale demonstration in a realistic geological model.

Advanced Methods and Mathematical Modeling of Biofilm Mojtaba Aghajani Delavar 2022-05-27 Advanced Mathematical Modelling of Biofilms and its Applications covers the concepts and fundamentals of biofilms, including sections on numerical discrete and numerical continuum models and different biofilms methods, e.g.,

the lattice Boltzmann method (LBM) and cellular automata (CA) and integrated LBM and individual-based model (iBM). Other sections focus on design, problem-solving and state-of-the-art modelling methods. Addressing the needs to upgrade and update information and knowledge for students, researchers and engineers on biofilms in health care, medicine, food, aquaculture and industry, this book also covers areas of uncertainty and future needs for advancing the use of biofilm models. Over the past 25-30 years, there have been rapid advances in various areas of computer technologies, applications and methods (e.g. complex programming and algorithms, lattice Boltzmann method, high resolution visualization and high-performance computation). These new and emerging technologies are providing unprecedented opportunities to develop modeling frameworks of biofilms and their applications. Introduces state-of-the-art methods of biofilm modeling, such as integrated lattice Boltzmann method (LBM) and cellular automata (CA) and integrated LBM and individual-based model (iBM) Provides recent progress in more powerful tools for a deeper understanding of biofilm complexity by implementing state-of-the art biofilm modeling programs Compares advantages and disadvantages of different biofilm models and analyzes some specific problems for model selection Evaluates novel process designs without the cost, time and risk of building a physical prototype of the process to identify the most promising designs for experimental testing

Reactive Transport Modeling Yitian Xiao 2018-06-05 Teaches the application of Reactive Transport Modeling (RTM) for subsurface systems in order to expedite the understanding of the behavior of complex geological systems This book lays out the basic principles and approaches of Reactive Transport Modeling (RTM) for surface and subsurface environments, presenting specific workflows and applications. The techniques discussed are being increasingly commonly used in a wide range of research fields, and the information provided covers fundamental theory, practical issues in running reactive transport models, and how to apply techniques in specific areas. The need for RTM in engineered facilities, such as nuclear waste repositories or CO2 storage sites, is ever increasing, because the prediction of the future evolution of these systems has become a legal obligation. With increasing recognition of the power of these approaches, and their widening adoption, comes responsibility to ensure appropriate application of available tools. This book aims to provide the requisite understanding of key aspects of RTM, and in doing so help identify and thus avoid potential pitfalls. Reactive

Transport Modeling covers: the application of RTM for CO2 sequestration and geothermal energy development; reservoir quality prediction; modeling diagenesis; modeling geochemical processes in oil & gas production; modeling gas hydrate production; reactive transport in fractured and porous media; reactive transport studies for nuclear waste disposal; reactive flow modeling in hydrothermal systems; and modeling biogeochemical processes. Key features include: A comprehensive reference for scientists and practitioners entering the area of reactive transport modeling (RTM) Presented by internationally known experts in the field Covers fundamental theory, practical issues in running reactive transport models, and hands-on examples for applying techniques in specific areas Teaches readers to appreciate the power of RTM and to stimulate usage and application Reactive Transport Modeling is written for graduate students and researchers in academia, government laboratories, and industry who are interested in applying reactive transport modeling to the topic of their research. The book will also appeal to geochemists, hydrogeologists, geophysicists, earth scientists, environmental engineers, and environmental chemists.

EuroCVD 17/CVD 17 M. T. Swihart 2009-09 This issue of ECS Transactions includes papers presented at the 2009 EuroCVD-17 and CVD 17 symposium. Topical areas covered include fundamentals of chemical vapor deposition (CVD), chemistry of precursors for CVD, synthesis of nanomaterials by CVD and related methods, industrial applications of CVD, and novel CVD reactors and processes. This issue is sold as a two-part set and also includes a CD-ROM of the entire issue.

Reactive Transport Modeling Yitian Xiao 2018-03-14 Teaches the application of Reactive Transport Modeling (RTM) for subsurface systems in order to expedite the understanding of the behavior of complex geological systems This book lays out the basic principles and approaches of Reactive Transport Modeling (RTM) for surface and subsurface environments, presenting specific workflows and applications. The techniques discussed are being increasingly commonly used in a wide range of research fields, and the information provided covers fundamental theory, practical issues in running reactive transport models, and how to apply techniques in specific areas. The need for RTM in engineered facilities, such as nuclear waste repositories or CO2 storage sites, is ever increasing, because the prediction of the future evolution of these systems has become a legal obligation. With increasing recognition of the power of these approaches, and their widening adoption, comes

responsibility to ensure appropriate application of available tools. This book aims to provide the requisite understanding of key aspects of RTM, and in doing so help identify and thus avoid potential pitfalls. Reactive Transport Modeling covers: the application of RTM for CO2 sequestration and geothermal energy development; reservoir quality prediction; modeling diagenesis; modeling geochemical processes in oil & gas production; modeling gas hydrate production; reactive transport in fractured and porous media; reactive transport studies for nuclear waste disposal; reactive flow modeling in hydrothermal systems; and modeling biogeochemical processes. Key features include: A comprehensive reference for scientists and practitioners entering the area of reactive transport modeling (RTM) Presented by internationally known experts in the field Covers fundamental theory, practical issues in running reactive transport models, and hands-on examples for applying techniques in specific areas Teaches readers to appreciate the power of RTM and to stimulate usage and application Reactive Transport Modeling is written for graduate students and researchers in academia, government laboratories, and industry who are interested in applying reactive transport modeling to the topic of their research. The book will also appeal to geochemists, hydrogeologists, geophysicists, earth scientists, environmental engineers, and environmental chemists.

Groundwater Reactive Transport Models Gour-Tsyh (George) Yeh 2012-03-15 Ground water reactive transport models are useful to assess and quantify contaminant precipitation, absorption and migration in subsurface media. Many ground water reactive transport models available today are characterized by varying complexities, strengths, and weaknesses. Selecting accurate, efficient models can be a challenging task. This book addresses the needs, issues and challenges relevant to selecting a ground water reactive transport model to evaluate natural attenuation and alternative remediation schemes. It should serve as a handy guide for water resource managers seeking to achieve economically feasible results.

Numerical Simulation of Reactive Flow in Hot Aquifers Christoph Clauser 2003 This book deals with the numerical simulation of reactive transport in porous media using the simulation package SHEMAT/Processing SHEMAT. SHEMAT (Simulator for HEat and MAss Transport) is an easy-to-use, general-purpose reactive transport simulation code for a wide variety of thermal and hydrogeological problems in two or three dimensions. You can download the updated version of the SHEMAT software from our Springer-Extras server:

http://extras.springer.com/2003/978-3-540-43868-7. The book is a richly documented manual for users of this software which discusses in detail the coded physical and chemical equations. Thus, it provides the in-depth background required by those who want to apply the code for solving advanced technical and scientific problems. The enclosed software and data package is applicable for all of the case studies. The software includes user-friendly pre- and post-processors which make it very easy to set up a model, run it and view the results, all from one platform. Therefore, the software is also very suitable for academic or technical "hands-on" courses for simulating flow, transport of heat and mass, and chemical reactions in porous media.

Modeling the Effect of Secondary Mineral Formation and Microbial Growth on the Hydraulic Properties of a Zero-valent Iron Barrier Eileen Marie Belding 2005

Growth and Transport in Nanostructured Materials Angel Yanguas-Gil 2016-11-30 This book will address the application of gas phase thin film methods, including techniques such as evaporation, sputtering, CVD, and ALD to the synthesis of materials on nanostructured and high aspect-ratio high surface area materials. We have chosen to introduce these topics and the different application fields from a chronological perspective: we start with the early concepts of step coverage and later conformality in semiconductor manufacturing, and how later on the range of application branched out to include others such as energy storage, catalysis, and more broadly nanomaterials synthesis. The book will describe the ballistic and continuum descriptions of gas transport on nanostructured materials and then will move on to incorporate the impact of precursor-surface interaction. We will finally conclude approaching the subjects of feature shape evolution and the connection between nano and reactor scales and will briefly present different advanced algorithms that can be used to effectively compute particle transport, in some cases borrowing from other disciplines such as radiative heat transfer. The book gathers in a single place information scattered over thirty years of scientific research, including the most recent results in the field of Atomic Layer Deposition. Besides a mathematical description of the fundamentals of thin film growth in nanostructured materials, it includes analytic expressions and plots that can be used to predict the growth using gas phase synthesis methods in a number of ideal approximations. The focus on the fundamental aspects over particular processes will broaden the appeal and the shelf lifetime of this book. The reader of this book will gain a thorough understanding on the coating of high surface area and nanostructured materials using

gas phase thin film deposition methods, including the limitations of each technique. Those coming from the theoretical side will gain the knowledge required to model the growth process, while those readers more interested in the process development will gain the theoretical understanding will be useful for process optimization.

Theory and Practice in Microbial Enhanced Oil Recovery Kun Sang Lee 2020-07-18 Selection of the optimal recovery method is significantly influenced by economic issues in today's oil and gas markets. Consequently, the development of cost-effective technologies, which bring maximum oil recovery, is the main interest in today's petroleum research communities. Theory and Practice in Microbial Enhanced Oil Recovery provides the fundamentals, latest research and creditable field applications. Microbial Enhanced Oil Recovery (MEOR) is potentially a low-priced and eco-friendly technique in which different microorganisms and their metabolic products are implemented to recover the remaining oil in the reservoir. Despite drastic advantages of MEOR technology, it is still not fully supported in the industry due to lack of knowledge on microbial activities and their complexity of the process. While some selected strategies have demonstrated the feasibility to be used on a mass scale through both lab and field trials, more research remains to implement MEOR into more oil industry practices. This reference delivers comprehensive descriptions on the fundamentals including basic theories on geomicrobiology, experiments and modeling, as well as current tested field applications. Theory and Practice in Microbial Enhanced Oil Recovery gives engineers and researchers the tool needed to stay up to date on this evolving and more sustainable technology. Covers fundamental screening criteria and theories selective plugging and mobility control mechanisms Describes the basic effects on environmental parameters and the mechanics of simulation, including microbial growth kinetics Applies up to date practical applications proven in both the lab and the field

Porous Media Kambiz Vafai 2010-08-24 Presenting state-of-the-art research advancements, Porous Media: Applications in Biological Systems and Biotechnology explores innovative approaches to effectively apply existing porous media technologies to biomedical applications. In each peer-reviewed chapter, world-class scientists and engineers collaborate to address significant problems and discuss exciting research in biological systems. The book begins with discussions on bioheat transfer equations for blood flows and surrounding

biological tissue, the concept of electroporation, hydrodynamic modeling of tissue-engineered material, and the resistance of microbial biofilms to common modalities of antibiotic treatments. It examines how biofilms influence porous media hydrodynamics, describes the modeling of flow changes in cerebral aneurysms, and highlights recent advances in Lagrangian particles methods. The text also covers passive mass transport processes in cellular membranes and their biophysical implications, the modeling and treatment of mass transport through skin, the use of porous media in marine microbiology, the transport of large biological molecules in deforming tissues, and applications of magnetic stabilized beds for protein purification and adsorption, antibody removal, and more. The final chapters present potential in situ characterization techniques for studying porous media and conductive membranes and explain the development of bioconvection patterns generated by populations of gravitactic microorganisms in porous media. Using a common nomenclature throughout and with contributions from top experts, this cohesive book illustrates the role of porous media in addressing some of the most challenging issues in biomedical engineering and biotechnology. The book contains sophisticated porous media models that can be used to improve the accuracy of modeling a variety of biological processes.

Water Reclamation Technologies for Safe Managed Aquifer Recharge Christian Kazner 2012 Different treatment applications in terms of behaviour of key microbial and chemical contaminants are assessed. Engineered as well as natural treatment trains are investigated to provide guidance for sustainable MAR schemes using alternative sources such as recycled water and stormwater. The technologies considered are also well suited to the needs of developing countries, which have a growing need of supplementation of freshwater resources. A broad range of international full-scale case studies enables insights into long-term system behaviour, operational aspects, and fate of a comprehensive number of compounds and contaminants, especially microbiological hazards, organic micropollutants and bulk organics.

Groundwater Assessment, Modeling, and Management M. Thangarajan 2016-09-15 Your Guide to Effective Groundwater Management Groundwater Assessment, Modeling, and Management discusses a variety of groundwater problems and outlines the solutions needed to sustain surface and ground water resources on a global scale. Contributors from around the world lend their expertise and provide an international perspective on groundwater management. They address the management of groundwater resources and pollution, waste water

treatment methods, and the impact of climate change on groundwater and water availability (specifically in arid and semi-arid regions such as India and Africa). Incorporating management with science and modeling, the book covers all areas of groundwater resource assessment, modeling, and management, and combines hands-on applications with relevant theory. For Water Resource Managers and Decision Makers The book describes techniques for the assessment of groundwater potential, pollution, prevention, and remedial measures, and includes a new approach for groundwater modeling based on connections (network theory). Approximately 30 case studies and six hypothetical studies are introduced reflecting a range of themes that include: groundwater basics and the derivation of groundwater flow equations, exploration and assessment, aquifer parameterization, augmentation of aquifer, water and environment, water and agriculture, the role of models and their application, and water management policies and issues. The book describes remote sensing (RS) applications, geographical information systems (GIS), and electrical resistivity methods to delineate groundwater potential zones. It also takes a look at: Inverse modeling (pilot-points method) Simulation optimization models Radionuclide migration studies through mass transport modeling Modeling for mapping groundwater potential Modeling for vertical 2-D and 3-D groundwater flow Groundwater Assessment, Modeling, and Management explores the management of water resources and the impact of climate change on groundwater. Expert contributors provide practical information on hydrologic engineering and groundwater resources management for students, researchers, scientists, and other practicing professionals in environmental engineering, hydrogeology, irrigation, geophysics, and environmental science.