Preface to the Third Edition

The first edition of "Percolation theory for flow in porous media" was short and focused. The point of the book was primarily to introduce readers to a suite of techniques, by which the author believed essentially all problems of flow, conduction, and diffusion in porous media could be solved, although it was also admitted that many problems that were in principle soluble by these techniques, were as yet unsolved. The strategy that was presented integrated critical path analysis with cluster statistics of percolation and scaling relationships. In the second edition we determined that some of the problems that we had left out could also be addressed in the general framework that was put forth, the most notable addition being the dispersion of solutes during advective transport. At the same time it was becoming clear to the authors that there was an entire suite of problems of interest to a number of different research communities that we had not even touched on, even though we had tried to expand the range of problems addressed. In this third edition we continue in the same vein as in the second, namely in a demonstration of the widening range of problems that we have tackled within this framework for solving problems. The principle motivation remains the same, however, to show that this particular combination of techniques from percolation theory can unify solutions of a wide range of problems. Although this preface therefore need not be long, we do wish to point out that we have greatly expanded the portions involving experimental verification of results, especially in the cases of air permeability, hydraulic conductivity, diffusion, and dispersion. And we have shown that our results for the spatio-temporal scaling of solute velocities give excellent predictions of the scaling of surface reaction rates over ten orders of magnitude of time scales. This, frankly unexpected, result means that the theoretical framework for dispersion of *non-reactive solutes* introduced in the previous edition, has relevance far beyond what was originally imagined, since the chemical weathering of silicate minerals in the earth's crust is among the reactions whose scaling behavior is described. And silicate weathering has an important role in many global phenomena, such as soil production and surface denudation rates, but most notably for the global carbon cycle, with its implications for climate change and extinctions.

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