

## Additional References

- [1] S. F. Ackley, V. I. Lytle, K. M. Golden, M. N. Darling, and G. A. Kuehn. Sea ice measurements during ANZFLUX. *Antarctic J. U. S.*, 30:133–135, 1995.
- [2] G. Allaire. Homogenization and two-scale convergence. *SIAM J. Math. Anal.*, 23:261–298, 1992.
- [3] G. Allaire. One-phase Newtonian flow. In U. Hornung, editor, *Homogenization and Porous Media*, pages 45–68. Springer – Verlag, 1997.
- [4] S. A. Arcone, A. J. Gow, and S. McGrew. Structure and dielectric properties at 4.8 and 9.5 GHz of saline ice. *J. Geophys. Res.*, 91(C12):14281–14303, 1986.
- [5] L. G. E. Backstrom and H. Eicken. Capacitance probe measurements of brine volume and bulk salinity in first-year sea ice. *Cold Reg. Sci. Tech.*, 46:167–180, 2006.
- [6] D. J. Bergman. The dielectric constant of a composite material – A problem in classical physics. *Phys. Rep. C*, 43(9):377–407, 1978.
- [7] D. J. Bergman. Exactly solvable microscopic geometries and rigorous bounds for the complex dielectric constant of a two-component composite material. *Phys. Rev. Lett.*, 44:1285, 1980.
- [8] D. J. Bergman. Rigorous bounds for the complex dielectric constant of a two-component composite. *Ann. Phys.*, 138:78, 1982.
- [9] B. Berkowitz and I. Balberg. Percolation approach to the problem of hydraulic conductivity in porous media. *Transport in Porous Media*, 9:275–286, 1992.
- [10] T. Bourbie and B. Zinszner. Hydraulic and acoustic properties as a function of porosity in Fontainebleau sandstone. *J. Geophys. Res.*, 90(B13):11,524–11,532, 1985.
- [11] S. R. Broadbent and J. M. Hammersley. Percolation processes I. Crystals and mazes. *Proc. Cambridge Philos. Soc.*, 53:629–641, 1957.
- [12] O. Bruno. The effective conductivity of strongly heterogeneous composites. *Proc. R. Soc. London A*, 433:353–381, 1991.
- [13] F. D. Carsey, editor. *Microwave Remote Sensing of Sea Ice, Geophysical Monograph 68*. American Geophysical Union, Washington D.C., 1992.
- [14] J. T. Chayes and L. Chayes. Bulk transport properties and exponent inequalities for random resistor and flow networks. *Comm. Math. Phys.*, 105:133–152, 1986.
- [15] E. Cherkaev. Inverse homogenization for evaluation of effective properties of a mixture. *Inverse Problems*, 17:1203–1218, 2001.

- [16] E. Cherkaev. Inverse homogenization with diagonal Padé approximants. *ICIAM07-Proceedings: Proceedings in Applied Mathematics and Mechanics (PAMM)*, 7(1), 2007.
- [17] E. Cherkaeva and K. M. Golden. Inverse bounds for microstructural parameters of composite media derived from complex permittivity measurements. *Waves in Random Media*, 8(4):437–450, 1998.
- [18] G. F. Dell’Antonio and V. Nesi. A general representation for the effective dielectric constant of a composite. *J. Math. Phys.*, 29:2688, 1988.
- [19] H. Eicken. Growth, microstructure and properties of sea ice. In D. N. Thomas and G. S. Dieckmann, editors, *Sea Ice: An Introduction to its Physics, Chemistry, Biology and Geology*, pages 22–81. Blackwell, Oxford, 2003.
- [20] H. Eicken, T. C. Grenfell, D. K. Perovich, J. A. Richter-Menge, and K. Frey. Hydraulic controls of summer Arctic pack ice albedo. *J. Geophys. Res. (Oceans)*, 109(C18):C08007.1–C08007.12, 2004.
- [21] J. Freitag and H. Eicken. Meltwater circulation and permeability of Arctic summer sea ice derived from hydrological field experiments. *J. Glaciol.*, 49:349–358, 2003.
- [22] A. P. Friedman and N. A. Seaton. Critical path analysis of the relationship between permeability and electrical conductivity of three-dimensional pore networks. *Water Resources Res.*, 34(7):1703–1710, 1998.
- [23] C. H. Fritsen, V. I. Lytle, S. F. Ackley, and C. W. Sullivan. Autumn bloom of Antarctic pack-ice algae. *Science*, 266:782–784, 1994.
- [24] R. Glantz and M. Hilpert. Invasion percolation through minimum weight spanning trees. 2008. preprint.
- [25] R. Glantz and M. Hilpert. Tight dual models of pore spaces. *Adv. Water Res.*, 2008. In press, doi: 10.1016/j.advwatres.2008.01.015 S0309-1708(08)00019-5.
- [26] K. Golden. Bounds on the complex permittivity of a multicomponent material. *J. Mech. Phys. Solids*, 34(4):333–358, 1986.
- [27] K. Golden. Exponent inequalities for the bulk conductivity of a hierarchical model. *Comm. Math. Phys.*, 43(3):467–499, 1992.
- [28] K. Golden. Bounds on the complex permittivity of sea ice. *J. Geophys. Res. (Oceans)*, 100(C7):13,699 – 13,711, 1995.
- [29] K. Golden and G. Papanicolaou. Bounds for effective parameters of heterogeneous media by analytic continuation. *Comm. Math. Phys.*, 90:473–491, 1983.
- [30] K. Golden and G. Papanicolaou. Bounds for effective parameters of multicomponent media by analytic continuation. *J. Stat. Phys.*, 40(5/6):655–667, 1985.

- [31] K. M. Golden. The interaction of microwaves with sea ice. In G. Papanicolaou, editor, *Wave Propagation in Complex Media, IMA Volumes in Mathematics and its Applications, Vol. 96*, pages 75 – 94. Springer – Verlag, 1997.
- [32] K. M. Golden. Percolation models for porous media. In U. Hornung, editor, *Homogenization and Porous Media*, pages 27 – 43. Springer – Verlag, 1997.
- [33] K. M. Golden and S. F. Ackley. Modeling of anisotropic electromagnetic reflection from sea ice. *J. Geophys. Res. (Oceans)*, 86(C9):8107–8116, 1981.
- [34] K. M. Golden, S. F. Ackley, and V. I. Lytle. The percolation phase transition in sea ice. *Science*, 282:2238–2241, 1998.
- [35] K. M. Golden and S. M. Kozlov. Critical path analysis of transport in highly disordered random media. In V. Berdichevsky, V. Jikov, and G. Papanicolaou, editors, *Homogenization: Serguei Kozlov Memorial Volume*, pages 21 – 34. World Scientific, 1999.
- [36] C. Haas. Evaluation of ship-based electromagnetic-inductive thickness measurements of summer sea-ice in the Bellingshausen and Amundsen Seas, Antarctica. *Cold Reg. Sci. Tech.*, 27:1–16, 1998.
- [37] C. Haas. Late-summer sea ice thickness variability in the Arctic Transpolar Drift 1991-2001 derived from ground-based electromagnetic sounding. *Geophys. Res. Lett.*, 31:L09402, doi:10.1029/2007GL030447, 2004.
- [38] C. Haas, S. Gerland, H. Eicken, and H. Miller. Comparison of sea-ice thickness measurements under summer and winter conditions in the Arctic using a small electromagnetic induction device. *Geophysics*, 62:749757, 1997.
- [39] B. I. Halperin, S. Feng, and P. N. Sen. Differences between lattice and continuum percolation transport exponents. *Phys. Rev. Lett.*, 54(22):2391–2394, 1985.
- [40] Z. Hashin and S. Shtrikman. A variational approach to the theory of effective magnetic permeability of multiphase materials. *J. Appl. Phys.*, 33:3125–3131, 1962.
- [41] M. Ingham, D. J. Pringle, and H. Eicken. Cross-borehole resistivity tomography of sea ice. *Cold Reg. Sci. Technol.*, 52:263–277, 10.1016/j.coldregions.2007.05.002, 2008.
- [42] P. D. Jackson, D. T. Smith, and P. N. Stanford. Resistivity-porosity-particle shape relationships for marine sands. *Geophysics*, 43:1250–1268, 1978.
- [43] J. B. Keller. Darcy’s law for flow in porous media and the two-space method. In R. L. Sternberg, editor, *Nonlinear Partial Differential Equations in Engineering and Applied Sciences*, pages 429–443. Dekker, 1980.
- [44] M. A. Knackstedt and S. F. Cox. Percolation and pore geometry of crustal rocks. *Phys. Rev. E*, 51(6A):R5181–R5184, 1995.

- [45] W. B. Lindquist and A. Venkatarangan. Investigating 3d geometry of porous media from high resolution images. *Phys. Chem. Earth*, A25:593–599, 1999.
- [46] W. B. Lindquist, A. Venkatarangan, J. Dunsmuir, and T.-F. Wong. Pore and throat size distributions measured from synchrotron x-ray tomographic images of fontainbleau sandstones. *J. Geophys. Res.*, 105B:21508–21528, 2000.
- [47] V. I. Lytle and S. F. Ackley. Heat flux through sea ice in the Western Weddell Sea: Convective and conductive transfer processes. *J. Geophys. Res.*, 101(C4):8853–8868, 1996.
- [48] T. Maksym and M. O. Jeffries. Phase and compositional evolution of the flooded layer during snow-ice formation of Antarctic sea ice. *Ann. Glac.*, 33:37–44, 2001.
- [49] J. A. Maslanik, C. Fowler, J. Stroeve, S. Drobot, J. Zwally, D. Yi, and W. Emery. A younger, thinner Arctic ice cover: Increased potential for rapid, extensive sea-ice loss. *Geophys. Res. Lett.*, 34:L24501, doi:10.1029/2007GL032043, 2007.
- [50] R. C. McPhedran, D. R. McKenzie, and G. W. Milton. Extraction of structural information from measured transport properties of composites. *Appl. Phys. A*, 29:19–27, 1982.
- [51] R. C. McPhedran and G. W. Milton. Inverse transport problems for composite media. *Mat. Res. Soc. Symp. Proc.*, 195:257–274, 1990.
- [52] M. G. McPhee, S. F. Ackley, P. Guest, B. A. Huber, D. G. Martinson, J. H. Morison, R. D. Muench, L. Padman, and T. P. Stanton. The Antarctic Zone Flux Experiment. *Bull. Amer. Met. Soc.*, 77:1221–1232, 1996.
- [53] G. W. Milton. Bounds on the complex dielectric constant of a composite material. *Appl. Phys. Lett.*, 37:300–302, 1980.
- [54] G. W. Milton. Multicomponent composites, electrical networks and new types of continued fractions I, II. *Comm. Math. Phys.*, 111:281–327, 329–372, 1987.
- [55] G. W. Milton and K. Golden. Representations for the conductivity functions of multicomponent composites. *Comm. Pure. Appl. Math.*, 43:647, 1990.
- [56] N. Ono and T. Kasai. Surface layer salinity of young sea ice. *Ann. Glaciol.*, 6:298–299, 1985.
- [57] C. Orum, E. Cherkaev, and K. M. Golden. Inverse bounds on the separation of inclusions in a composite from effective property measurements. In preparation.
- [58] D. K. Perovich and A. J. Gow. A quantitative description of sea ice inclusions. *J. Geophys. Res.*, 101(C8):18,327–18,343, 1996.
- [59] C. Petrich, P. J. Langhorne, and Z. F. Sun. Modelling the interrelationships between permeability, effective porosity and total porosity in sea ice. *Cold Reg. Sci. Tech.*, 44(2):131–144, 2006.

- [60] D. C. Powell and T. Markus. Effects of snow depth forcing on Southern Ocean sea ice simulations. *J. Geophys. Res. C (Oceans)*, 110:C06001, doi:10.1029/2003JC002212, 2005.
- [61] D. J. Pringle, M. Ingham, H. Eicken, G. Dubuis, and L. Backstrom. Tracking the evolution of sea ice properties with in-situ dielectric probes and cross-borehole resistivity tomography. *Eos Trans. AGU*, 88(52), 2007. Fall Meet. Suppl., Abstract NS11A-0157.
- [62] D. J. Pringle, J. E. Miner, H. Eicken, and K. M. Golden. Pore-space percolation in sea ice single crystals. Submitted, October, 2008.
- [63] D. J. Pringle, J. E. Miner, R. Glantz, M. Hilpert, and H. Eicken. Temperature-dependent pore space of sea ice: X-ray computed tomography and dual model network analysis. *Eos Trans. AGU*, 87(52), 2006. Fall Meet. Suppl., Abstract H51F-0545.
- [64] M. Prodanovic, W. B. Lindquist, and R. S. Seright. 3D image-based characterization of fluid displacement in a Berea core. *Adv. Water Res.*, 30(2):214–226, 2007.
- [65] J. E. Reid, A. Pfaffling, A. P. Worby, and J. R. Bishop. In situ measurements of the direct-current conductivity of Antarctic sea ice: implications for airborne electromagnetic sounding of sea-ice thickness. *Ann. Glaciol.*, 44:217–223, 2006.
- [66] J. E. Reid, A. P. Worby, J. Vrbancich, and A. I. S. Munro. Shipborne electromagnetic measurements of Antarctic sea-ice thickness. *Geophysics*, 68(5):1537–1546, 2003.
- [67] J. Richter-Menge, J. Comiso, W. Meier, S. Nghiem, and D. Perovich. Sea ice cover. *Arctic Report Card*, 2008. National Oceanic and Atmospheric Administration, [www.arctic.noaa.gov/reportcard/seaiice.html](http://www.arctic.noaa.gov/reportcard/seaiice.html).
- [68] J. Rubinstein and S. Torquato. Flow in random porous media: Mathematical formulation variational principles, and rigorous bounds. *J. Fluid Mech.*, 206, 1989.
- [69] M. Sahimi. *Flow and Transport in Porous Media and Fractured Rock*. VCH, Weinheim, 1995.
- [70] P. N. Sen, C. Scala, and M. H. Cohen. A self-similar model for sedimentary rocks with application to the dielectric constant of fused glass beads. *Geophysics*, 46:781–795, 1981.
- [71] R. A. Shuchman and R. G. Onstott. Remote sensing of the polar oceans. In W. O. Smith, editor, *Polar Oceanography, Part A, Physical Science*, pages 123–169. Academic Press, 1990.
- [72] A. H. Sihvola and J. A. Kong. Effective permittivity of dielectric mixtures. *IEEE Trans. Geosci. Remote Sensing*, 26(4):420–429, 1988.
- [73] J. Stroeve, M. M. Holland, W. Meier, T. Scambos, and M. Serreze. 2007: Arctic sea ice decline: Faster than forecast. *Geophys. Res. Lett.*, 34:L09591, doi: 10.1029/2007GL029703, 2007.

- [74] L. Tartar. Incompressible fluid flow in a porous medium. In E. Sanchez-Palencia, editor, *Non-Homogeneous Media and Vibration Theory, Volume 129 of Lecture Notes in Physics*, pages 368–377. Springer – Verlag, 1980.
- [75] D. N. Thomas and G. S. Dieckmann. Antarctic sea ice – a habitat for extremophiles. *Science*, 295:641–644, 2002.
- [76] S. Torquato. *Random Heterogeneous Materials: Microstructure and Macroscopic Properties*. Springer-Verlag, New York, 2002.
- [77] H. J. Trodahl, M. J. McGuinness, P. J. Langhorne, K. Collins, A. E. Pantoja, I. J. Smith, and T. G. Haskell. Heat transport in McMurdo Sound first-year fast ice. *J. Geophys. Res.*, 105(C5):11347–11358, 2000.
- [78] M. R. Vant, R. O. Ramseier, and V. Makios. The complex-dielectric constant of sea ice at frequencies in the range 0.1–40 GHz. *J. Appl. Phys.*, 49(3):1264–1280, 1978.
- [79] W. F. Weeks and A. J. Gow. Crystal alignments in the fast ice of Arctic Alaska. *J. Geophys. Res.*, 85(C2):1137–1146, 1980.
- [80] J. S. Wettlaufer, M. G. Worster, and H. E. Huppert. Natural convection during solidification of an alloy from above with application to the evolution of sea ice. *J. Fluid Mech.*, 344:291–316, 1997.
- [81] O. Wiener. Die theorie des mischkorpers fur das feld des stationaren stromung. *Abhandl. Math., Phys. Klasse Königl. Sacsh. Gesel. Wissen*, 32:509–604, 1912.
- [82] D. P. Winebrenner, J. Bredow, A. K. Fung, M. R. Drinkwater, S. Nghiem, A. J. Gow, D. K. Perovich, T. C. Grenfell, H. C. Han, J. A. Kong, J. K. Lee, S. Mudaliar, R. G. Onstott, L. Tsang, and R. D. West. Microwave sea ice signature modeling. In F. D. Carsey, editor, *Microwave Remote Sensing of Sea Ice, Geophysical Monograph 68*, pages 137–175. American Geophysical Union, 1992.
- [83] D. Zhang and E. Cherkaev. Padé approximations for identification of air bubble volume from temperature or frequency dependent permittivity of a two-component mixture. *Inverse Problems in Science and Engineering*. In print.
- [84] D. Zhang and E. Cherkaev. Reconstruction of the spectral function from effective permittivity of a composite material using rational function approximations. Submitted.