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References

- J.F. Peterson, "The development of pulse oximetry," Science, vol. 232, pp. G1355-G140, 1986.
- [2] J.M. Schmitt, "Simple photon diffusion analysis of the effects of multiple scattering on pulse oximetry," *IEEE Trans. Biomed. Eng.*, vol. 38, pp. 1194-1203, 1991.
- [3] D.R. Marble, D.H. Burns, and P.W. Cheung, "Diffusion-based model for pulse oximetry: In-vivo and in-vitro comparisons," *Appl. Optics*, vol. 33, pp. 1279-1285, 1994.
- [4] Y. Mendelson and B.D. Ochs, "Noninvasive pulse oximetry utilizing skin reflectance photoplethysmography," *IEEE Trans. Biomed. Eng.*, vol. 35, pp. 798-805, 1988.
- [5] N.A. Kumar and M.D. Schnall, "MR imaging: Its current and potential utility in the diagnosis and management of breast cancer," *Magnetic Resonance Imaging Clinics N. Amer.*, vol. 8, no. 4, pp. 715-728, Nov. 2000.
- [6] R. Weissleder, "Molecular imaging: Exploring the next frontier," *Radiology*, vol. 212, no. 3, pp. 609-614, Sept. 1999.
- [7] C. Bremer and R. Weissleder, "In vivo imaging of gene expression," Acad. Radiol., vol. 8, no. 1, pp. 15-23, Jan. 2001.
- [8] A. Villringer and B. Chance, "Non-invasive optical spectroscopy and imaging of human brain function," *Trends Neurosci.*, vol. 20, pp. 435-442, 1997.

- [9] J. Steinbrink, M. Kohl, H. Obrig, G. Curio, F. Syre, F. Thomas, H. Wabnitz, H. Rinneberg, and A. Villringer, "Somatosensory evoked fast optical intensity changes detected non-invasively in the adult human head," Neurosci. Lett., vol. 291, no. 2, pp. 105-108, 2000.
- [10] G. Gratton, M. Fabbiani, P.M. Corballis, D.C. Hood, M.R. Good-man-Wood, J. Hirsch, K. Kim, D. Friedman, and E. Gratton, "Fast and localized event-related optical signals (EROS) in human occipital cortex: Comparisons with the visual evoked potential and fMRI," *NeuroImage*, vol. 6, no. 3, pp. 168-180, 1997.
- [11] National Institute of Neurological Disorders and Stroke rt-pa Stroke Study Group, "Tissue plasminogen activator for acute stroke," New Eng. J. Med., vol. 333, pp. 1581-1587, 1995.
- [12] S.R. Arridge, "Optical tomography in medical imaging," *Inverse Problems*, vol. 15, no. 2, pp. R41-R93, Apr. 1999.
- [13] M. Cutler, "Transillumination of the breast," Surg. Gynecol. Obstet., vol. 48, pp. 721-727, 1929.
- [14] C.M. Gros, Y. Quenneville, and Y.J. Hummel, "Diaphanologic mammaire," *Radiol. Electrol. Med. Nucl.*, vol. 53, pp. 297-306, 1972.
- [15] E. Carlsen, "Transillumination light scanning," *Diagn. Imaging*, vol. 4, pp. 28-34, 1982.
- [16] A. Alveryd, I. Andersson, K. Aspegren, G. Balldin, N. Bjurstam, G. Edstrom, G. Fagerberg, U. Glas, O. Jarlman, and S.A. Larsson, "Light scanning versus mammography for the detection of breast cancer in screening and clinical practice," *Cancer*, vol. 65, pp. 1671-1677, 1990.
- [17] T. Tanaka, C. Riva, and I. Ben-Sira, "Blood velocity measurements in human retinal vessels," *Science*, vol. 186, p. 830, 1974.
- [18] M. Stern, "In vivo evaluation of microcirculation by coherent light scattering," *Nature (London)*, vol. 254, p. 56, 1975.
- [19] R. Bonner and R. Nossal, "Model for laser doppler measurements of blood flow in tissue," Appl. Optics, vol. 20, pp. 2097-2107, June 15, 1981.
- [20] F.F. Jobsis, "Noninvasive infrared monitoring of cerebral and myocardial sufficiency and circulatory parameters," *Science*, vol. 198, pp. 1264-1267, 1977.
- [21] M. Cope and D.T. Delpy, "System for long-term measurement of cerebral blood flow and tissue oxygenation on newborn infants by infra-red transillumination," Med. Biol. Eng. Comput., vol. 26, pp. 289-294, 1988.
- [22] M. Cope, "The development of a near-infrared spectroscopy system and its application for noninvasive monitoring of cerebral blood and tissue oxygenation in the newborn infant," Ph.D. dissertation, Dept. Med. Phys. Biol., University College London, U.K., 1991.
- [23] S. Wary, M. Cope, and D.T. Delpy, "Characteristics of the near infrared absorption spectra of cytochrome aa3 and hemoglobin for the noninvasive monitoring of cerebral oxygenation," *Biochim. Biophys. Acta*, vol. 933, pp. 184-192, 1988.
- [24] C.E. Elwell, M. Cope, A.D. Edwards, J.S. Wyatt, D.T. Delpy, and E.O.R. Reynolds, "Quantification of adult cerebral hemodynamics by near-infrared spectroscopy," J. Appl. Physiology, vol. 77, pp. 2753-2760, 1994.
- [25] M.S. Patterson, B. Chance, and B.C. Wilson, "Time resolved reflectance and transmittance for the non-invasive measurement of tissue optical properties," Appl. Optics, vol. 28, pp. 2331-2336, 1989.
- [26] B. Chance, M. Cope, E. Gratton, N. Ramanujam, and B. Tromberg, "Phase measurement of light absorption and scattering in human tissues," *Rev. Sci. Instr.*, vol. 689, pp. 3457-3481, 1998.
- [27] S.R. Arridge, "Forward and inverse problems in time-resolved infrared imaging," Medical Opt. Tomography: Functional Imaging and Monitoring, vol. 11, pp. 35-64, 1993.
- [28] R.L Barbour, H.L. Graber, Y. Wang, J. Chang, and R. Aronson, "Perturbation approach for optical diffusion tomography using continuous-wave and time-resolved data," *Medical Opt. Tomography: Functional Imaging and Monitoring*, vol. 11, pp. 87-120, 1993.

- [29] D.A. Benaron and D.K. Stevenson, "Optical time-of-flight and absorbance imaging of biologic media," *Science*, vol. 259, no. 5100, pp. 1463-1466, 1993.
- [30] B. Chance, et al., "Comparison of time-resolved and unresolved measurements of deoxyhemoglobin in brain," Proc. Nat. Acad. Sci. USA, vol. 85, pp. 4971-4975, 1988.
- [31] R. Cubeddi, A. Pifferi, P. Taroni, A. Torricelli, and G. Valentini, "Time-resolved imaging on a realistic tissue phantom: mus' and mua images versus time-integrated images," *Appl. Optics*, vol. 35, pp. 4533-4540, 1996.
- [32] J.S. Hebden, S.R. Arridge, and D.T. Delpy, "Optical imaging in medicine: I. Experimental techniques," *Phys. Med. Biol.*, vol. 42, pp. 825-840, 1997.
- [33] D. Grosenick, H. Wabnitz, and H. Rinneberg, "Time-resolved imaging of solid phantoms for optical mammography," *Appl. Optics*, vol. 36, no. 1, pp. 221-231, 1997.
- [34] S. Nioka, Q. Luo, and B. Chance, "Human brain functional imaging with reflectance cws," Adv. Exp. Med. Biol., vol. 428, pp. 237-242, 1997.
- [35] A.M. Siegel, J.J.A. Marota, and D.A. Boas, "Design and evaluation of a continuous-wave diffuse optical tomography system," *Optics Express*, vol. 4, pp. 287-298, 1999.
- [36] A. Maki, Y. Yamashita, E. Watanabe, and H. Koizumi, "Visualizing human motor activity by using non-invasive optical topography," Front. Med. Biol. Eng., vol. 7, no. 4, pp. 285-297, 1996.
- [37] W. Colier, M.C. van der Sluijs, J. Menssen, and B. Oeseburg, "A new and highly sensitive optical brain imager with 50 hz sample rate," *NeuroImage*, vol. 11, p. 542, 2000.
- [38] E. Gratton, S. Fantini, A. Franceschini, G. Gratton, and M. Fabiani, "Measurements of scattering and absorption changes in muscle and brain," *Phils. Tran. R. Soc. Lond. B. Biol. Sci.*, vol. 352, pp. 727-735, 1997.
- [39] H. Jiang, H.K. Paulsen, U.L. Osterberg, B.W. Pogue, and M.S. Patterson, "Simultaneous reconstruction of optical absorption and scattering maps in turbid media from near-infrared frequency-domain data," Opt. Lett., vol. 20, pp. 2128-2130, 1995.
- [40] B.W. Pogue and M.S. Patterson, "Frequency-domain optical-absorption spectroscopy of finite tissue volumes using diffusion-theory," *Phys. Med. Biol.*, vol. 39, pp. 1157-1180, 1994.
- [41] S.A. Prahl, "Optical absorption of hemoglobin," Oregon Medical Laser Center, OR, Tech. Rep., Dec. 15, 1999.
- [42] G. Mitic, J. Kolzer, J. Otto, E. Plies, G. Solkner, and W. Zinth, "Time-gated transilumination of biological tissues and tissuelike phantoms," *Appl. Optics*, vol. 33, no. 28, pp. 6699-6710, Oct. 1, 1994.
- [43] F. Bevilacqua, D. Piguet, P. Marquet, J.D. Gross, Bruce J. Tromberg, and C. Depeursinge, "In vivo local determination of tissue optical properties: Applications to human brain," *Appl. Optics*, vol. 38, no. 22, pp. 4939-4950, Aug. 1, 1999.
- [44] W.f. Cheong, S.A. Prahl, and A.J. Welch, "A review of the optical properties of biological tissues," *IEEE J. Quantum Electron.*, vol. 26, pp. 2166-2185, Dec. 1990.
- [45] A.E. Cerussi, A.J. Berger, F. Bevilacqua, N. Shah, D. Jakubowski, J. Butler, R.F. Holcombe, and B.J. Tromberg, "Sources of absorption and scattering contrast for near-infrared optical mammography," *Acad. Radiol.*, vol. 8, no. 3, pp. 211-218, 2001.
- [46] B.J. Tromberg, L.O. Svaasand, T. Tsay, and R.C. Haskell, "Properties of photon density waves in multiple-scattering media," *Appl. Optics*, vol. 32, pp. 607-616, 1993.
- [47] J.B. Fishkin and E. Gratton, "Propagation of photon density waves in strongly scattering media containing an absorbing 'semi-infinite' plane bounded by a straight edge," J. Opt. Soc. Amer. A, vol. 10, pp. 127-140, 1993.
- [48] M.A. O'Leary, D.A. Boas, B. Chance, and A.G. Yodh, "Refraction of diffuse photon density waves," Phys. Rev. Lett., vol. 69, pp. 2658-2661, 1992.

- [49] B.W. Pogue and M.S. Patterson, "Frequency-domain optical-absorption spectroscopy of finite tissue volumes using diffusion-theory," *Phys. Med. Biol.*, vol. 39, pp. 1157-1180, 1994.
- [50] E. Gratton, W. Mantulin, M.J. van de Ven, J. Fishkin, M. Maris, and B. Chance, in Proc. 3rd Int. Conf.: Peace through Mind/Brain Science, Hamamatsu, Japan, 1990, p. 183.
- [51] A. Mandelis, "Diffusion waves and their uses," Phys. Today, vol. 53, no. 8, Part 1, pp. 29-34, Aug. 2000.
- [52] A. Sommerfeld, Partial Differential Equations in Physics. New York: Academic, 1949, p. 68.
- [53] A.M. Zhabotinsky, M.D. Eager, and I.R. Epstein, "Refraction and reflection of chemical waves," Phys. Rev. Lett., vol. 71, pp. 1526-1529, 1993.
- [54] L. Wang, S.L. Jacques, and X. Zhao, "Continuous-wave ultrasonic modulation of scattered laser light to image objects in turbid media," Opt. Lett., vol. 20, no. 6, pp. 629-631, 1995.
- [55] G.W. Brooksby and C.M. Penney, "Measurement of ultrasonically modulated scattered light for imaging in turbid media," in Proc. SPIE, Optical Tomography, Photon Migration, and Spectroscopy of Tissue and Model Media: Theory, Human Studies, and Instrumentation, vol. 2389, May 1995, pp. 564-570.
- [56] S. Leveque, A.C. Boccara, M. Lebec, and H. Saint-Jalmes, "Ultrasonic tagging of photon paths in scattering media: Parallel speckle modulation processing," Opt. Soc. Amer., vol. 24, no. 3, pp. 181-183, Feb. 1999.
- [57] T.J. Gaudette, R. Gaudette, and C.A. DiMarzio, "A new imaging technique combining diffusive photon density waves and focused ultrasound," in *Proc. SPIE*, Optical Tomography and Spectroscopy of Tissue III, vol. 3597, 1999, pp. 376-384.
- [58] M.A. O'Leary, D.A. Boas, D.X. Li, B. Chance, and A.G. Yodh, "Flourescence lifetime imaging in turbid media," *Opt. Lett.*, vol. 21, pp. 158-160, 1996.
- [59] D.Y. Paithankar, A.U. Chen, B.W. Pogue, M.S. Patterson, and E.M. Sevick-Muraca, "Imaging of fluorescent lifetime and yield from multiple scattered light reemitted from tissues and other random media," Appl. Optics, vol. 36, pp. 2260-2272, 1997.
- [60] J. Chang, H.L. Graber, and R.L. Barbour, "Luminescence optical tomography of dense scattering media," J. Opt. Soc. Amer. A, vol. 14, pp. 288-299, 1997.
- [61] M.J. Eppstein, D.E. Dougherty, T.L. Troy, and E.M. Sevick-Muraca, "Biomedical optical tomography using dynamic parameterization and Bayesian conditioning on photon migration measurements," *Appl. Optics*, vol. 38, no. 10, pp. 2138-2150, Apr. 1, 1999.
- [62] V. Ntziachristos, A.G. Yodh, M. Schnall, and B. Chance, "Concurrent MRI and diffuse optical tomography of breast after indocyanine green enhancement," Proc. Nat. Acad. Sci. USA, vol. 97, pp. 2767-2772, 2000.
- [63] D.J. Hawrysz and E.M. Sevick-Muraca, "Developments towards diagnostic breast cancer imaging using near-infrared optical measurements and fluorescent contrast agents," *Neoplasia*, vol. 2, pp. 388-417, 2000.
- [64] D.A. Boas, T. Gaudette, and S.R. Arridge, "Simultaneous imaging and optode calibration with diffuse optical tomography," Opt. Express, vol. 8, pp. 263-270, 2001.
- [65] A. Tikhonov and V. Arsenin, Solution of Ill-Posed Problems. Washington, DC: Winston, 1977.
- [66] P.C. Hansen, Rank-Deficient and Discrete Ill-Posed Problems. Philadelphia, PA: SIAM, 1998.
- [67] K.M. Case and P.F. Zweifel, Linear Transport Theory. Reading, MA: Addison-Wesley, 1967.
- [68] A. Ishimaru, Wave Propagation and Scattering in Random Media. New York: IEEE Press, 1997.
- [69] O. Dorn, "A transport-backtransport method for optical tomography," Inv. Prob., vol. 14, no. 5, pp. 1107-1130, Oct. 1998.

- [70] R.C. Haskell, L.O. Svaasand, T.-T. Tsay, T.-C. Feng, M.S. McAdams, and B.J. Tromberg, "Boundary conditions for the diffusion equation in radiative transfer," J. Opt. Soc. Amer. A, vol. 11, no. 10, pp. 2727-2741, Oct. 1994.
- [71] D.A. Boas, "Diffuse photon probes of structural and dynamical properties of turbid media: Theory and biomedical applications," Ph.D. dissertation, Dept. Physics, Univ. Pennsylvania, Philadelphia, PA, 1996.
- [72] T. Durduran, A.G. Yodh, B. Chance, and D.A. Boas, "Does the photon-diffusion coefficient depend on absorption," J. Opt. Soc. Amer. A, vol. 14, no. 12, pp. 3358-3365, Dec. 1997.
- [73] D.J. Durian, "The diffusion coefficient depends on absorption," Opt. Lett., vol. 23, no. 19, pp. 1502-1504, Oct. 1, 1998.
- [74] W.B. Pogue and M.S. Patterson, "Frequency-domain optical absorption spectroscopy of finite tissue volumes using diffusion theory," *Phys. Med. Biol.*, vol. 39, pp. 1157-1180, 1994.
- [75] A. Dunn and D.A. Boas, "Transport-based image reconstruction in turbid media with small source-detector separations," Opt. Lett., vol. 25, pp. 1777-1779, 2000.
- [76] A.D. Klose and A.H. Hielscher, "Iterative reconstruction scheme for optical tomography based on the equation of radiative transfer," *Med. Phys.*, vol. 26, no. 8, pp. 1698-1707, Aug. 1999.
- [77] M. Firbank, S.R. Arridge, M. Schweiger, and D.T. Delpy, "An investigation of light transport through scattering bodies with non-scattering regions," *Phys. Med. Biol.*, vol. 41, pp. 767-783, 1996.
- [78] H. Dehghani, S.R. Arridge, M. Schweiger, and D.T. Delpy, "Optical to-mography in the presence of void regions," *J. Opt. Soc. Amer. A*, vol. 17, no. 9, pp. 1659-1669, Sept. 2000.
- [79] J. Riley, H. Dehghanni, M. Schweiger, S. Arridge, J. Ripoll, and M. Nieto-Vesperinas, "3D optical tomography in the presence of void regions," Opt. Express, vol. 7, no. 13, pp. 462-467, Dec. 2000.
- [80] H. Dehghani, D.T. Delpy, and S.R. Arridge, "Photon migration in nonscattering tissue and the effects on image reconstruction," *Phys. Med. Biol.*, vol. 44, pp. 2297-2906, 1999.
- [81] R.J. Gaudette, D.H. Brooks, C.A. DiMarzio, M.E. Kilmer, E.L. Miller, T. Gaudette, and D.A. Boas, "A comparison study of linear reconstruction techniques for diffuse optical tomographic imaging of absorption coefficient," *Phys. Med. Biol.*, vol. 45, no. 4, pp. 1051-1070, Apr. 2000.
- [82] E. Dereniak and D.G. Crowe, Optical Radiation Detectors (Wiley series in Pure and Applied Optics). New York: Wiley, 1984.
- [83] D.A. Boas, M.A. O'Leary, B. Chance, and A.G. Yodh, "Scattering of diffuse photon density waves by spherical inhomgeneities within turbid media: Analytical solutions and applications," Proc. Nat. Acad. Sci. USA, vol. 91, pp. 4887-4891, May 1994.
- [84] S.A. Walker, D.A. Boas, and E. Gratton, "Photon density waves scattered from cylindrical inhomegeneities: Theory and experiments," *Appl. Optics*, vol. 37, no. 10, pp. 1935-1944, Apr. 1, 1998.
- [85] H.L. Braber, J. Chang, R. Aronson, and R.L. Barbour, "A perturbation model for imaging in dense scattering media: Derivation and evaluation of imaging operators," in *Institute Series of SPIE Optical Engineering, Medical Optical Tomography: Functional Imaging and Monitoring*, G. Muller, B. Chance, R.R. Alfano, S.R. Arridge, J. Beuthan, E. Gratton, M. Kaschke, B.R. Masters, S. Svanberg, and P. van der Zee, Eds., vol. IS11, Bellingham, WA, 1993, pp. 121-143.
- [86] R.L. Barbour, H.L. Braber, R. Aronson, and J. Lubovsky, "Imaging of subsurface regions of random media by remote sensing," in *Proc. SPIE*, *Time-Resolved Spectroscopy and Imaging of Tissues*, B. Chance and A. Katzir, Eds., vol. 1431, 1991, pp. 192-203.
- [87] A.C. Kak and M. Slaney, Principles of Computerized Tomographic Imaging. New York: IEEE Press, 1988.
- [88] C.W. Groetsch, The Theory of Tikhonov Regularization for Fredholm Equations of the First Kind. Boston, MA: Pitman, 1984.

- [89] M.A. O'Leary, D.A. Boas, B. Chance, and A.G. Yodh, "Experimental images of heterogenous turbid media by frequency-domain diffusing-photon tomography," Opt. Lett., vol. 20, no. 5, pp. 426-428, Mar. 1, 1995.
- [90] M.A. O'Leary, "Imaging with diffuse photon density waves," Ph.D. dissertation, Dept. Physics, Univ. Pennsylvania, Philadelphia, PA, 1996.
- [91] H.L. Graber, R.L. Barbour, and J. Chang, "Algebraic reconstruction of images of a diffusive medium containing strong absorbers: Comparative study of different illuminations schemes and the effect of restricted view angle," in Proc. SPIE, Optical Tomography: Photon Migration and Spectroscopy of Tissue and Model Media: Theory, Human Studies, and Instrumentation, B. Chance and R.R. Alfano, Eds., vol. 2389, 1995, pp. 431-447.
- [92] J. Chang, R. Aronson, H.L. Graber, and R.L. Barbour, "Imaging diffusive media using time-independent and time-harmonic sources: Dependence of image quality on imaging algorithms, target volume, weight matrix and view angles," in Proc. SPIE, Optical Tomography: Photon Migration and Spectroscopy of Tissue and Model Media: Theory, Human Studies, and Instrumentation, B. Chance and R.R. Alfano, Eds., vol. 2389, 1995, pp. 448-464.
- [93] J. Chang, H.I. Graber, and R.L. Barbour, "Image reconstruction of dense scattering media from CW sources using constrained CGD and matrix rescaling technique," in Proc. SPIE, Optical Tomography: Photon Migration and Spectroscopy of Tissue and Model Media: Theory, Human Studies, and Instrumentation, B. Chance and R.R. Alfano, Eds., vol. 2389, 1995, pp. 682-691.
- [94] W. Zhu, Y. Wang, J. Chang, H. L. Graber, and R. L. Barbour, "A total least squares approach for the solution of the perturbation equations," in Proc. SPIE, Optical Tomography: Photon Migration and Spectroscopy of Tissue and Model Media: Theory, Human Studies, and Instrumentation, B. Chance and R.R. Alfano, Eds., vol. 2389, 1995, pp. 420-430.
- [95] W. Zhu, Y. Wang, Y. Yao, J. Chang, H.L. Graber, and R.L. Barbour, "It-crative total least-squares image reconstruction algorithm for optical to-mography by the conjugate gradient method," J. Opt. Soc. Amer. A, vol. 14, no. 4, pp. 799-807, Apr. 1997.
- [96] B.W. Pogue, T.O. McBride, J. Prewitt, U.L. Osterberg, and K.D. Paulsen, "Spatially variant regularization improves diffuse optical tomography," *Appl. Optics*, vol. 38, no. 13, pp. 2950-2961, May 1999.
- [97] D.H. Brooks, R.J. Gaudette, E.L. Miller, C.A. DiMarzio, D.A. Boas, and M.E. Kilmer, "An admissible solution approach for diffuse optical tomography," in *Proc. 34th Asilomar Conf. Sig.*, Sys, and Comp. Pacific Grove, CA, Oct. 2000.
- [98] J. Chang, H.L. Graber, R.L. Barbour, and R. Aronson, "Recovery of optical cross-section perturbations in dense scattering media by transport-theory-based imaging operators and steady-state simulated data," *Appl. Optics*, vol. 35, no. 20, pp. 3963-3975, July 10, 1996.
- [99] M.V. Klibanov, T.R. Lucas, and R.M. Frank, "A fast and accurate imaging algorithm in optical/diffusion tomography," *Inverse Problems*, vol. 13, pp. 1341-1361, 1997.
- [100] M.V. Klibanov and T.R. Lucas, "Numerical solution of a parabolic inverse problem in optical tomography using experimental data," SIAM J. App. Math., vol. 59, no. 5, pp. 1763-1789, 1999.
- [101] J.C. Schotland, "Continuous-wave diffusion imaging," J. Opt. Soc. Amer. A, vol. 14, no. 1, pp. 275-279, Jan. 1997.
- [102] V.A. Markel and J.C. Schotland, "The inverse problem in optical diffusion tomography. i. Fourier-Laplace inversion formulas," J. Opt. Soc. Amer. A, vol. 18, no. 6, pp. 1336-1347, June 2001.

- [103] J.C. Schotland and V.A. Markel, "Inverse scattering with diffuse waves," J. Opt. Soc. Amer. A, , to be published.
- [104] E. Okada, M. Firbank, M. Schweiger, S.R. Arridge, M. Cope, and D.T. Delpy, "Theoretical and experimental investigation of near-infrared light propagation in a model of the adult head," *Appl. Optics*, vol. 37, pp. 21-31, 1997
- [105] Y. Yao, Y. Wang, Y. Pei, W. Zhu, and R.L. Barbour, "Simultaneous reconstruction of absorption and scattering distributions in turbid media using a Born iterative method," in *Proc. SPIE, Experimental and Numerical Methods for Solving Ill-Posed Inverse Problems: Medical and Nonmedical Applications*, R. Barbour, M. Carvlin, and M. Fiddy, Eds., vol. 2570, 1995, pp. 96-107.
- [106] W. Zhu, Y. Wang, Y. Deng, and R.L. Barbour, "Multiresolution regularized least squares image reconstruction based on wavelet in optical tomography," in *Proc. SPIE, Experimental and Numerical Methods for Solving Ill-Posed Inverse Problems: Medical and Nonmedical Applications*, R. Barbour, M. Carvlin, and M. Fiddy, Eds., vol. 2570, 1995, pp. 186-197.
- [107] Y. Yao, Y. Wang, Y. Pei, W. Zhu, and R.L. Barbour, "Frequency-domain optical imaging of absorption and scattering distributions by a Born iterative method," J. Opt. Soc. Amer. A, vol. 14, no. 1, pp. 325-342, Jan. 1997.
- [108] J.C. Ye, K.J. Webb, R.P. Millane, and T.J. Downar, "Modified distorted Born iterative method with an approximate Frechet derivative for optical diffusion tomography," J. Opt. Soc. Amer. A, vol. 16, no. 7, pp. 1814-1826, July 1999.
- [109] D.A. Boas, T. Gaudette, and S. Arridge, "Simultaneous imaging and optode calibration with diffuse optical tomography," Opt. Express, vol. 8, no. 5, pp. 263-270, Feb. 2001.
- [110] Richard J. Gaudette, "Constrained reconstruction techniques for diffuse optical tomography," Ph.D. dissertation, Dept. Elec. Comp. Eng., Northeastern Univ., Sept. 2000.
- [111] M. Schweiger and S.R. Arridge, "Optical tomography reconstruction in a complex head model using a priori region boundary information," *Phys. Med. Biol.*, vol. 44, no. 11, pp. 2703-2721, Nov. 1999.
- [112] V. Kolehmainen, M. Vauhkonen, J.P. Kaipio, and S.R. Arrridge, "Recovery of piecewise constant coefficients in optical diffusion tomography," Opt. Express, vol. 7, no. 13, pp. 481-491, Dec. 2000.
- [113] M. Vauhkonen V. Kolehmainen, S.R. Arridge, and J.P. Kaipio, "Simultaneous reconstruction of internal tissue region boundaries and coefficients in optical diffusion tomography," *Phys. Med. Biol.*, vol. 45, pp. 3267-3283, 2000
- [114] M.E. Kilmer, E.L. Miller, D.A. Boas, D.H. Brooks, C.A. DiMarzio, and R.J. Gaudette, "Direct object localization and characterization from diffuse photon density wave data," in *Proc. SPIE, Optical Tomography and Spectros*copy of Tissue III, B. Chance, R.R. Alfano, and B. Tromberg, Eds., vol. 3597, 1999, pp. 45-54.
- [115] M.E. Kilmer, E.L. Miller, D.A Boas, and D.H. Brooks, "A shape-based reconstruction technique for DPDW data," Opt. Express, vol. 7, no. 13, pp. 481-491, Dec. 2000.
- [116] S.T. Flock, S.L. Jacques, B.C. Wilson, W.M. Star, and M.J.C. van Gemert, "Optical properties of intralipid: A phantom medium for light propagation studies," *Lasers in Surgery and Medicine*, vol. 12, pp. 510-519, 1992.