Publications of Charles W. Wampler

Books

[1] Bates, D. J., Hauenstein, J. D., Sommese, A. J., and Wampler, C. W., *Numerically Solving Polynomial Systems with Bertini*, SIAM Books, Philadelphia, PA, 2013.

[2] Sommese, A. J., and Wampler, C. W., *Numerical Solution of Systems of Polynomials Arising in Engineering and Science*, World Scientific, Singapore, 2005.

[3] Wampler, C. W., *Computer Methods in Manipulator Kinematics, Dynamics, and Control: A Comparative Study*, Ph. D. Thesis, Stanford University, December 1984.

EditedBooks

[1] Bates, D., Besana, G.-M., Di Rocco, S., and Wampler, C., (Eds.), *Interactions of Classical and Numerical Algebraic Geometry*, Contemporary Mathematics 496, Amer. Math. Soc., Providence, R.I., 2009.

BookChapters

[1] Wampler, C.W., and Sommese, A.J., "Applying Numerical Algebraic Geometry to Kinematics," Chapter 5, *21st Century Kinematics*, Springer, 2012, pp. 125–159.

[2] Sommese, A., Verschelde, J., and Wampler, C., "Introduction to Numerical Algebraic Geometry," Chapter 8, *Solving Polynomial Equations: Foundations, Algorithms, and Applications*, Algorithms and Computation in Mathematics 14, A.Dickenstein, I.Z.Emiris (Eds.), Springer, 2005, pp. 339–392.

[3] Wampler, C.W., "Wrist singularities: Theory and practice," *The Robotics Review 2*, O. Khatib, J. Craig, and T. Lozano-Pérez (Eds.), MIT Press, 1992, pp. 173–189.

Articles

[1] J.D. Hauenstein, C. Hills, A.J. Sommese, and C.W. Wampler, "Branch points of homotopies: Distribution and probability of failure," Applied Math. & Computation, 493 129273. DOI:10.1016/j.amc.2024.129273

[2] A. Baskar, M. Plecnik, J.D. Hauenstein, and C.W. Wampler, "A numerical continuation approach using monodromy to solve the forward kinematics of cable-driven parallel robots with sagging cables," Mechanism & Machine Theory, Volume 195, DOI:10.1016/j.mechmachtheory.2024.1056092024.

[3] A. Baskar, M. Plecnik, J.D. Hauenstein, and C.W. Wampler, "A real-time algorithm for computing the tension force in a suspended elastic sagging cable," Proceedings MSR-RoManSy 2024, May 22-25, 2024 Springer Nature, DOI:10.1007/978-3-031-60618-2.

[4] M. He, C.W. Wampler, *et al.*,"Revealing the mechanism behind sudden capacity loss in lithium metal batteries," J. Electrochem. Soc., 170 100528. DOI:10.1149/1945-7111/ad01e7; Erratum: J. Electrochem. Soc., 171 029001. DOI: 10.1149/1945-7111/ad1f36.

[5] E. Baker, C. Wampler, and D. Baker, "Triply invertible scarf sewing adventures (and instructions)," J. Mathematics and the Arts, 2023. DOI:10.1080/17513472.2023.2200897

[6] R. Fabbri, *et al.*, "Trifocal relative pose from lines at points," IEEE Trans. Pattern Analysis Machine Intelligence, 45:6:7870-7884, 2023.

[7] S. N. Sherman, J. D. Hauenstein, and C. W. Wampler, "Advances in the theory of planar curve cognates," J. Mech. Robotics, 14:3:2022. DOI:10.1115/1.4052806.

[8] S. N. Sherman, J. D. Hauenstein, and C. W. Wampler, "A general method for constructing planar cognate mechanisms," J. Mech. Robotics, 13:3:2021. DOI:10.1115/1.4050293.

[9] S. N. Sherman, J. D. Hauenstein, and C. W. Wampler, "Curve cognate constructions made easy," Proc. ASME Design Engineering Tech. Conf., (virtual), Aug. 17-19, 2020, DOI:10.1115/DETC2020-22409.

[10] R. Fabbri, *et al.*, "Trifocal relative pose from lines at points and its efficient solution: expanded version

with supplementary material," Conf. Computer Vision & Pattern Recognition (CVPR 2020), Seattle, June 16-18, 2020.

[11] M. W. Verbrugge, C. W. Wampler, and D. R. Baker, "Smoothing methods for numerical differentiation to identify electrochemical reactions from open-circuit-potential data," J. Electrochem. Soc., 165:16:A4000-A4011, 2018. DOI:10.1149/2.0951816jes

[12] M. W. Verbrugge and C. W. Wampler, "On the optimal sizing of batteries for electric vehicles and the influence of fast charge," J. Power Sources, 384:312-317, 2018. DOI:10.1016/j.jpowsour.2018.02.064 Corrigendum, 396:831-832, 2018. DOI:10.1016/j.jpowsour.2018.06.076

[13] Hauenstein, J.D., Sherman, S.N., and Wampler, C.W., "Exceptional Stewart-Gough platforms, Segre embeddings, and the special Euclidean group," SIAM J. Appl. Algebra Geometry, 2:1:179–205, 2018. DOI:10.1137/17M1114284

[14] D. A. Brake, D. J. Bates, W. Hao, J. D. Hauenstein, A. J. Sommese, and C. W. Wampler, Algorithm 976: Bertini_real: Numerical Decomposition of Real Algebraic Curves and Surfaces. ACM Trans. Math. Softw. 44, 1, Article 10 (July 2017). DOI:10.1145/3056528

[15] D. J. Bates, D. A. Brake, J. D. Hauenstein, A. J. Sommese, and C. W. Wampler, "Homotopies for connected components of algebraic sets with application to computing critical sets," In: Blömer J., Kotsireas I., Kutsia T., Simos D. (eds) MACIS 2017. Lecture Notes in Computer Science, vol 10693. Springer, Cham. DOI:10.1007/978-3-319-72453-9_8

[16] Hauenstein, J.D., and Wampler, C.W., and Pfurner, M., "Synthesis of three-revolute spatial chains for body guidance," Mech. Mach. Theory, 110:61-72, 2017. DOI:10.1016/j.mechmachtheory.2016.12.008

[17] Hauenstein, J.D., and Wampler, C.W., "Unification and extension of intersection algorithms in numerical algebraic geometry," Applied Math. Comp., 293:226-243, 2017. DOI:10.1016/j.amc.2016.08.023.

[18] Almestiri, S. M., Myszka, D. H., Murray, A. P., and Wampler, C. W., "Singularity traces of single degree-of-freedom planar linkages that include prismatic and revolute joints," ASME J. Mechanism & Robotics, 8(5):051003-051003-3, 2016. DOI:10.1115/1.4032410

[19] Brake, D. A., Hauenstein, J. D., Murray, A. P., Myszka, D. H., and Wampler, C. W., "The complete solution of Alt-Burmester synthesis problems for four-bar linkages," ASME J. Mechanism & Robotics, 8:4:041018, 2016. DOI:10.1115/1.4033251

[20] Wampler, C.W. "Robotics," In N.J. Higham, et al, eds., *The Princeton Companion to Applied Mathematics*, pp. 767–769. Princeton University Press, Princeton, NJ, USA, 2015.

[21] Almestiri, S. M., Myszka, D. H., Murray, A. P., and Wampler, C. W., "Singularity traces of planar linkages that include prismatic and revolute joints," DETC2015-47390, Proc. ASME Int. Design Eng. Tech. Conf. (IDETC), Boston, MA, August 2–5, 2015.

[22] Plecnik, M., McCarthy, J.M., and Wampler, C.W., "Kinematic synthesis of a Watt I six-bar linkage for body guidance," in *Advances in Robot Kinematics*, Springer, pp. 317–325, 2014

[23] Brake, D.A., Bates, D.J., Hao, W., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Bertini_real: Software for one- and two-dimensional real algebraic sets," *Mathematical Software — ICMS 2014: 4th International Congress, Seoul, South Korea, August 5-9, 2014. Proceedings*, H. Hong & C. Yap, eds., Springer, pp. 175–182, 2014. DOI:10.1007/978-3-662-44199-2_29

[24] Bates, D.J., Brake, D.A., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "On computing a cell decomposition of a real surface containing infinitely many singularities," *Mathematical Software — ICMS 2014: 4th International Congress, Seoul, South Korea, August 5-9, 2014. Proceedings*, H. Hong & C. Yap, eds., Springer, pp. 246–252, 2014. DOI:10.1007/978-3-662-44199-2_39

[25] Bates, D.J., Decker, W., Hauenstein, J.D., Peterson, C., Pfister, G., Schreyer, F.-O., and Wampler, C.W., "Comparison of probabilistic algorithms for analyzing the components of an affine algebraic variety," Applied Math. Comp., 231:619–633, 2014.

[26] Myszka, D.H., Murray, A.P., and Wampler, C.W., "Computing the branches, singularity trace, and critical points of single degree-of-freedom, closed-loop linkages," ASME J. Mechanism & Robotics, 6:1:011006-

011006-10, 2013. DOI: 10.1115/1.4025752

[27] Abdallah, M., Wampler, C.W., and Platt, R., "Decoupled torque control of tendon-driven fingers with tension management," Int. J. Robotics Research, 32(2):247-258, 2013.

[28] Hauenstein, J.D., and Wampler, C.W., "Isosingular sets and deflation," Found. Comp. Math. (FoCM), 13:3:371–403, 2013. DOI:10.1007/s10208-013-9147-y

[29] Besana, G.M., Di Rocco, S., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Cell decomposition of almost smooth real algebraic surfaces," Numerical Algorithms, 63:4:645–678, 2013. DOI:10.1007/s11075-012-9646-y

[30] Hauenstein, J.D., and Wampler, C.W., "Numerically intersecting algebraic varieties via witness sets," Applied Math. Computation, 219:5730–5742, 2013. DOI:10.1016/j.amc.2012.06.034.

[31] Permenter, F., Wampler, C., and Tedrake, R., A numerical algebraic geometry approach to regional stability analysis of polynomial systems. In American Control Conference (ACC), June 2013 (pp. 2127-2132). IEEE.

[32] Myszka, D.H., Murray, A.P., and Wampler, C.W., "Mechanism branches, turning curves, and critical points," paper DETC2012-70277, Proc. ASME Int. Design Eng. Tech. Conf. (IDETC), Chicago, IL, August 12–15, 2012.

[33] Hauenstein, J., Sommese, A.J., and Wampler, C.W., "Regenerative cascade homotopies for solving polynomial systems," Applied Math. Comp., 218:4:1240–1246, 2011.
DOI:10.1016/j.amc.2011.06.004

[34] Wampler, C.W., and Sommese, A.J., "Numerical Algebraic Geometry and Algebraic Kinematics," Acta Numerica, 20:469–567, 2011. DOI:10.1017/S0962492911000067.

[35] Wampler, C.W., Hauenstein, J.D., and Sommese, A.J., "Mechanism Mobility and a Local Dimension Test," Mech. & Machine Theory, 46:9:1193–1206, 2011.
DOI:10.1016/j.mechmachtheory.2011.04.011

[36] Bates, D.J., Peterson, C., Sommese,A.J., and Wampler, C.W., "Numerical computation of the genus of an irreducible curve within an algebraic set," J. Pure & Applied Algebra, 215:8:1844-1851, 2011.

[37] Arends, F., Ouaknine, J., and Wampler, C.W., "On Searching for Small Kochen-Specker Vector Systems," Proc. 37th Intl. Workshop on Graph-Theoretic Concepts in Computer Science (WG'11), Teplá Monastery, Czech Republic, June 21–23, 2011.

[38] Platt, R., Abdallah, M.E., and Wampler, C.W., "Multiple-Priority Impedance Control," Proc. 2011 IEEE Conf. Robotics & Automation (ICRA), Shanghai, May 9–13, 2011.

[39] Abdallah, M.E., and Wampler, C.W., "Torque control of underactuated tendon-driven fingers," Mech. Sci., 2:1:83-90, 2011. Available at `www.mech-sci.net/2/83/2011`.

[40] Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Regeneration homotopies for solving systems of polynomials," Math. Comp., AMS, 80:273:345–377, 2011.

[41] Abdallah, M.E., Platt, R., Wampler, C.W., and Hargrave, B., "Applied joint-space torque and stiffness control of tendon-driven fingers," Proc. IEEE-RAS Intl. Conf. Humanoid Robots, Nashville, TN, Dec. 6–8, 2010.

[42] Abdallah, M.E., Wampler, C.W., and Platt, R., "Object impedance control using a closed-chain task definition," Proc. IEEE-RAS Intl. Conf. Humanoid Robots, Nashville, TN, Dec. 6–8, 2010.

[43] Platt, R., Abdallah, M.E., and Wampler, C.W., "Multi-Priority Cartesian Impedance Control," Robotics: Science & Systems Conf. (RSS), Zaragoza, Spain, June 27-30, 2010.

[44] Di Rocco, S., Eklund, D., Sommese, A.J., and Wampler, C.W., "Algebraic $\mathbb{C}^*$-actions and the inverse kinematics of a general 6R manipulator," Applied Math. & Comp., 216:9: 2512–2524, 2010.

[45] Bates, D.J., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Stepsize control for adaptive multiprecision path tracking," in *Interactions of Classical and Numerical Algebraic Geometry*, D. Bates, G.-M.

Besana, S. Di Rocco, and C. Wampler (Eds.), Contemporary Mathematics, Vol. 496, pp. 21–31, Amer. Math. Soc., 2009.

[46] Gao, D., and Wampler, C.W., "Head Injury Criterion: Assessing the Danger of Robot Impact," IEEE Robotics & Automation Magazine, pp. 71–74, Dec. 2009.

[47] Bates, D.J., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Adaptive multiprecision path tracking," SIAM Journal on Numerical Mathematics, 46:2:722-746, 2008.

[48] Sommese, A.J., and Wampler, C.W., "Exceptional sets and fiber products," Foundations of Computational Mathematics, 8:2:171-196, 2008.

[49] Bates, D.J., Hauenstein, J.D., Sommese, A.J., and Wampler, C.W., "Software for numerical algebraic geometry: a paradigm and progress towards its implementation," in *Software for Algebraic Geometry*, IMA Volumes in Math. and its Applications, Vol. 148, eds. M. Stillman, N. Takayama, and J. Verschelde, Springer, 2008.

[50] Sommese, A.J., Verschelde, J., and Wampler, C.W., "Solving polynomial systems equation by equation," in *Algorithms in Algebraic Geometry*, IMA Volumes in Math. and its Applications, Vol. 146, eds. A. Dickenstein, F.-O. Schreyer, and A.J. Sommese, Springer, 2008.

[51] Lu, Y., Bates, D.J., Sommese, A.J., and Wampler, C.W., "Finding all real points of a complex curve," In *Proceedings of the Midwest Algebra, Geometry and Its Interactions Conference*, Contemporary Mathematics, AMS, 448:183–205, 2007.

[52] Izquierdo, L.E., Shi, J., Hu, S.J., and Wampler, C. W., "Feedforward control of multistage assembly processes using programmable tooling," Trans. of the NAMRI/SME, Society of Manufacturing Engineers, 2007.

[53] Wampler, C.W., Larson, B.T., Erdman, A.G., "A New Mobility Formula for Spatial Mechanisms," paper DETC2007-35574, Proc. ASME Design Engineering Technical Conf., Las Vegas, Sept. 4–7, 2007.

[54] Wampler, C.W., "Numerical algebraic geometry and kinematics," Proc. 2007 Int. Workshop on Symbolic-Numeric Computation (SNC'07), London, ON, Canada, July 25-27, 2007, J. Verschelde and S. Watt, Eds., Assoc. Computing Machinery, New York.

[55] Wampler, C., "On a rigid body subject to point-plane constraints," ASME J. of Mechanical Design, 128:1:151–158, Jan. 2006.

[56] Allgower, E.L., Bates, D.J., Sommese, A.J., and Wampler, C.W., "Solution of polynomial systems derived from differential equations," Computing, Online First, SpringerLink, August 25, 2005; Computing, 76:(1-2):1-10, Jan 2006.

[57] Sommese, A., Verschelde, J., and Wampler, C., "An intrinsic homotopy for intersecting algebraic varieties," Journal of Complexity, Vol. 21, No. 4, 2005, pp. 593–608.

[58] Wampler, C., "Locating N points of a rigid body on N given planes," paper DETC2004-57182, Proc. ASME Design Engineering Technical Conf., Salt Lake City, Sept. 28–Oct. 2, 2004.

[59] Wampler, C., "Singular foci of planar linkages," Mechanism Machine Theory, Vol. 39, No. 11, 2004, pp 1123–1138.

[60] Wampler, C., "The geometry of singular foci of planar linkages," Mechanism Machine Theory, Vol. 39, No. 11, 2004, pp 1139-1153.

[61] Sommese, A., Verschelde, J., and Wampler, C., "Homotopies for intersecting solution components of polynomial systems," SIAM J. Numerical Analysis, Vol. 42, No. 4, 2004, pp. 1552–1571.

[62] Sommese, A., Verschelde, J., and Wampler, C., "Numerical factorization of multivariate complex polynomials," Theoretical Computer Science, Vol. 315, No. 2–3, 2004, pp. 651–669.

[63] Su, H.-J., Wampler, C., and McCarthy, J.M., "Geometric design of cylindric PRS serial chains," ASME J. Mechanical Design, Vol. 126, No. 2, 2004, pp. 269–277. (Also in: Proc. ASME Design Engineering Technical Conf., Chicago, September 26, 2003.)

[64] Sommese, A., Verschelde, J., and Wampler, C., "Advances in polynomial continuation for solving problems in kinematics," ASME J. Mechanical Design, Vol. 126, No. 2, 2004, pp. 262–268. (Also in: Paper DETC2002/MECH-34254, Proc. ASME Design Engineering Technical Conf. (CDROM), Montreal, Quebec, Sept. 29-Oct. 2, 2002.)

[65] Wampler, C., "Displacement analysis of spherical mechanisms having three or fewer loops," ASME J. Mechanical Design, Vol. 126, No. 1, 2004, pp. 93–100. (Also in: Paper DETC2002/MECH-34326, Proc. ASME Design Engineering Technical Conf. (CDROM), Montreal, Quebec, Sept. 29-Oct. 2, 2002.

[66] Fisch, A., Nikitczuk, J., Weinberg, B., Melli-Huber, J., Mavroidis, C., and Wampler, C., "Development of an electro-rheological fluidic actuator and haptic systems for vehicular instrument control," Proc. ASME IMECE Conference, Washington, D.C., Nov. 15–21, 2003.

[67] Melli-Huber, J., Weinberg, B., Fisch, A., Nikitczuk, J., Mavroidis, C., and Wampler, C., "Electro-rheological fluidic actuators for haptic vehicular instrument controls," Proc. 2003 IEEE Haptics Symposium, Los Angeles, Mar. 22–23, 2003.

[68] Sommese, A., Verschelde, J., and Wampler, C., "Numerical irreducible decomposition using PHCpack." In *Algebra, Geometry and Software Systems,* ed. M. Joswig and N. Takayama, pp. 109–130, Springer-Verlag 2003.

[69] Sommese, A., Verschelde, J., and Wampler, C., "Symmetric functions applied to decomposing solution sets of polynomial systems," SIAM J. Numerical Analysis, Vol. 40, No. 6, pp. 2026-2046, 2002.

[70] Sommese, A., Verschelde, J., and Wampler, C., "A method for tracking singular paths with application to the numerical irreducible decomposition," In *Algebraic Geometry, a Volume in Memory of Paolo Francia,* ed. by M.C. Beltrametti, et al., pp. 329–345, W. de Gruyter, 2002.

[71] Sommese, A., Verschelde, J., and Wampler, C., "Numerical irreducible decomposition using projections from points on the components," In *Symbolic Computation: Solving Equations in Algebra, Geometry, and Engineering,* ed. E.L. Green, et al., Contemporary Mathematics, volume 286, pp. 37–51, AMS, 2001.

[72] Sommese, A., Verschelde, J., and Wampler, C., "Using monodromy to decompose solution sets of polynomial systems into irreducible components," In *Application of Algebraic Geometry to Coding Theory, Physics, and Computation,* ed. C. Ciliberto, et al., pp. 297–315, Kluwer Academic Publishers, 2001.

[73] Wampler, C., "Solving the kinematics of planar mechanisms by Dixon determinant and a complex-plane formulation," ASME J. Mechanical Design, Vol. 123, No. 3, 2001, pp. 382–387. (Also in Proc. ASME Design Engr. Tech. Conf. (CDROM), Sept. 10–13, 2000, Baltimore, MD.)

[74] Sommese, A., Verschelde, J., and Wampler, C., "Numerical decomposition of the solution sets of polynomial systems into irreducible components," SIAM J. Numerical Analysis, Vol. 38, No. 6, pp. 2022-2046, 2001.

[75] Wampler, C., "Solving the kinematics of planar mechanisms," ASME J. Mechanical Design, Vol. 121, No. 3, 1999, pp. 387–391. (Also in Proc. ASME Design Engr. Tech. Conf. (CDROM), Sept. 13–16, 1998, Atlanta, Ga.)

[76] Wampler, C., Morgan, A., and Sommese, A., "Complete solution of the nine-point path synthesis problem for four-bar linkages: Author's closure," ASME J. Mechanical Design, Vol. 119, No. 1, 1997, pp. 150–152.

[77] Wampler, C.W., "Forward displacement analysis of general six-in-parallel SPS (Stewart) platform manipulators using soma coordinates," Mechanism and Machine Theory, Vol. 31, No. 3, 1996, pp. 331–337.

[78] Wampler, C.W., "Isotropic coordinates, circularity, and Bezout numbers: Planar kinematics from a new perspective," Proc. ASME Design Engr. Tech. Conf. (CDROM), Aug. 18-22, 1996, Irvine, CA.

[79] Sommese, A.J., and Wampler, C.W., "Numerical algebraic geometry," Lectures in Applied Mathematics: The Mathematics of Numerical Analysis, Vol. 32, American Mathematical Society, Province, R.I., 1996, pp. 749–763.

[80] Hollerbach, J.M., and Wampler, C.W., "The calibration index and a taxonomy for robot kinematic

calibration methods," Int. J. of Robotics Research, Vol. 15, No. 6, 1996, pp. 573–591.

[81] Hollerbach, J.M., and Wampler, C.W., "The calibration index and the role of input noise in robot calibration," Robotics Research: The Seventh International Symposium, G. Giralt and G Hirzinger, eds., Springer-Verlag, London, 1996, pp. 558-568.

[82] Wampler, C.W., Hollerbach, J.M., and Arai, T., "An implicit loop method for kinematic calibration and its application to closed-chain mechanisms," IEEE Trans. Robotics and Automation, Vol. 11, No. 5, 1995, pp. 710–724.

[83] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "A product-decomposition theorem for bounding Bezout numbers," SIAM J. Numer. Anal., Vol. 32, No. 4, 1995, pp. 1308–1325.

[84] Wampler, C.W., "An efficient start system for multi-homogeneous polynomial continuation," Numerische Mathematik, 66:517–523, 1994.

[85] Wampler, C.W., and Morgan, A.P., "Solving the kinematics of general 6R manipulators using polynomial continuation," Robotics: Applied Mathematics and Computational Aspects, K. Warwick, ed., Clarendon Press, Oxford, 1993, pp. 57–69.

[86] Wampler, C.W., "Type synthesis of mechanisms for variable valve actuation," SAE technical paper 930818, March 1993.

[87] Wampler, C.W., Arai, T., "Calibration of robots having kinematic closed loops using non-linear least-squares estimation," Proc. IFToMM-jc Symposium on Theory of Machines and Mechanisms, Nagoya, Japan, Sept. 24–26, 1992, Vol. 1, pp. 153–158.

[88] Wampler, C.W., "Bezout number calculations for multi-homogeneous polynomial systems," Applied Mathematics and Computation, Vol. 51, 1992, pp. 143–157.

[89] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "A power series method for computing singular solutions to nonlinear analytic systems," Numerische Mathematik, Vol. 63, 1992, pp. 391–409.

[90] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "Computing singular solutions to polynomial systems," Advances in Applied Mathematics, Vol. 13, 1992, pp. 305–327.

[91] Wampler, C.W., Morgan, A.P. and Sommese, A.J., "Complete solution of the nine-point path synthesis problem for four-bar linkages," Journal of Mechanical Design, Vol. 114, No. 1, March 1992, pp. 153–159.

[92] Wampler, C.W., "A new Jacobian formulation for general six-revolute manipulators," Proc. IEEE Int. Conf. on Robotics and Automation, Sacramento, CA, April 9–11, 1991, Vol. 2, pp. 1046–1051.

[93] Wampler, C.W., and Morgan, A.P., "Solving the 6R inverse position problem using a generic-case solution methodology," Mechanism and Machine Theory, Vol. 26, No. 1, 1991, pp. 91–106.

[94] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "Computing singular solutions to nonlinear analytic systems," Numerishe Mathematik, Vol. 58, 1991, pp. 669–684.

[95] Wampler, C.W., Morgan, A.P., and Sommese, A.J., "Complete solution of the nine-point path synthesis problem for four-bar linkages," *Mechanism Synthesis and Analysis*, Editor: M. McCarthy, et.al., ASME DE-Vol. 25, Amer. Soc. Mech. Eng., New York, 1990, pp. 361–366.

[96] Morgan, A.P., and Wampler, C.W., "Solving a planar four-bar design problem using continuation," ASME J. of Mechanical Design, Vol. 112, No. 4, December 1990, pp. 544–550.

[97] Wampler, C.W., Morgan, A.P., and Sommese, A.J. "Numerical continuation methods for solving polynomial systems arising in kinematics," ASME J. of Mechanical Design, Vol. 112, No. 1, March 1990, pp. 59–68.

[98] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "Polynomial continuation for mechanism design problems," Lectures in Applied Mathematics, Vol. 26, *Computational Solution of Nonlinear Systems of Equations*, Editors: E.L. Allgower and K. Georg, Amer. Math. Society, Providence, RI, 1990, pp. 495–517.

[99] Wampler C.W., and Agrawal, S.K., "An implementation of inverse kinematic functions for control of a redundant wrist," Proc. IEEE Int. Conf. on Robotics and Automation, Scottsdale, Az., May 14–19, 1989,

Vol. 2, pp. 914–919.

[100] Wampler, C.W., “Inverse kinematic functions for redundant spherical wrists,” IEEE Trans. on Robotics and Automation, Vol. 5, No. 1, Feb. 1989, pp. 106–111.

[100] Wampler, C.W., “Winding number analysis of invertible workspaces for redundant manipulators,” Int. J. of Robotics Research, Vol. 7, No. 5, Oct. 1988, pp. 22–31. (Reprinted from Proc. of 26th IEEE Conf. on Decision and Control, Dec. 9–11, 1987, Los Angeles, Ca., Vol. 1, pp. 564–569.)

[101] Wampler, C.W., “Inverse kinematics of a seven-degree-of-freedom manipulator,” Proc. of NATO Advanced Research Workshop on Robots with Redundancy, June 27–July 1, 1988, Salo, Italy.

[102] Wampler, C.W., “The inverse function approach to kinematic control of redundant manipulators,” Proc. of the American Control Conference, June 15–17, 1988, Atlanta, Ga., pp. 1364–1369.

[103] Baker, D. R., and Wampler, C. W., “On the inverse kinematics of redundant manipulators,” Int. J. of Robotics Research, Vol. 7, No. 2, April 1988, pp. 3–21. (Reprinted in *Robot Control: Dynamics, Motion Planning, and Analysis*, ed. M. Spong, F. Lewis, and C. Abdallah, IEEE Press, New York, 1993, pp. 468–486.) (Reviewed by T. Yoshikawa, The Robotics Review 2, MIT Press, 1992, pp. 207–210.)

[104] Wampler, C. W., and Leifer, L.J., “Applications of damped least-squares methods to resolved-rate and resolved-acceleration control of manipulators,” ASME J. of Dynamic Systems, Measurement and Control, Vol. 110, No.1, March 1988, pp. 31–38.

[105] Wampler, C.W., “The inverse function approach to sensor-driven kinematic control of redundant manipulators,” *Kinematic and Dynamic Issues in Sensor Based Control,* Editor: G.E. Taylor, NATO ASI Series F, Vol. 57, Springer-Verlag, Berlin, 1990, pp. 45–58.

[106] Baker, D. R., and Wampler, C. W., “Some facts concerning the inverse kinematics of redundant manipulators,” Proc. of IEEE Int. Conf. on Robotics and Automation, March 31–April 3, 1987, Raleigh, N.C., Vol. 2, pp. 604–609.

[107] Wampler, C. W., “Inverse kinematic functions for redundant manipulators,” Proc. of IEEE Int. Conf. on Robotics and Automation, March 31–April 3, 1987, Raleigh, N.C., Vol. 2, pp. 610–617.

[108] Wampler, C. W., “Manipulator inverse kinematic solutions based on vector formulations and damped least-squares methods,” IEEE Trans. on Systems, Man, and Cybernetics, Vol. SMC-16, No. 1, Jan.-Feb. 1986, pp. 93–101.

[109] Wampler, C., Buffinton, K., and Shu-hui, J., “Formulation of equations of motion for systems subject to constraints,” ASME J. of Applied Mechanics, Vol. 52, No. 2, June 1985, pp. 465–470.

[110] Wampler, C. W., “Multiprocessor control of a telemanipulator with optical proximity sensors,” Int. J. of Robotics Research, Vol. 3, No. 1, Spring 1984, pp. 40–50.