

Publications of Charles W. Wampler

Books

- [1] Sommese, A. J., and Wampler, C. W., *Numerical Solution of Systems of Polynomials Arising in Engineering and Science*, World Scientific, Singapore, 2005.
- [2] Wampler, C. W., *Computer Methods in Manipulator Kinematics, Dynamics, and Control: A Comparative Study*, Ph. D. Thesis, Stanford University, December 1984.

Edited Books

- [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.

Book Chapters

- [1] 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.
- [2] 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] 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.
- [2] 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
- [3] Wampler, C.W., and Sommese, A.J., “Numerical Algebraic Geometry and Algebraic Kinematics,” *Acta Numerica*, 20:469–567, 2011. DOI:10.1017/S0962492911000067.
- [4] Wampler, C.W., Hauenstein, J.D., and Sommese, A.J., “Mechanism Mobility and a Local Dimension Test,” *Mech. & Machine Theory*, 2011. DOI:10.1016/j.mechmachtheory.2011.04.011
- [5] 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.
- [6] 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.

- [7] 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.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.
- [15] Gao, D., and Wampler, C.W., “Head Injury Criterion: Assessing the Danger of Robot Impact,” IEEE Robotics & Automation Magazine, pp. 71–74, Dec. 2009.
- [16] 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.
- [17] Sommese, A.J., and Wampler, C.W., “Exceptional sets and fiber products,” *Foundations of Computational Mathematics*, 8:2:171-196, 2008.
- [18] 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.
- [19] 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.
- [20] 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.

- [21] 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.
- [22] 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*.
- [23] 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*.
- [24] Wampler, C., “On a rigid body subject to point-plane constraints,” *ASME J. of Mechanical Design*, 128:1:151–158, Jan. 2006.
- [25] Allgower, E.L., Bates, D.J., Sommese, A.J., and Wampler, C.W., “Solution of polynomial systems derived from differential equations,” *Computing, Online First, Springer-Link*, August 25, 2005; *Computing*, 76:(1-2):1-10, Jan 2006.
- [26] 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.
- [27] 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*.
- [28] Wampler, C., “Singular foci of planar linkages,” *Mechanism Machine Theory*, Vol. 39, No. 11, 2004, pp 1123–1138.
- [29] Wampler, C., “The geometry of singular foci of planar linkages,” *Mechanism Machine Theory*, Vol. 39, No. 11, 2004, pp 1139–1153.
- [30] 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.
- [31] 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.
- [32] 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*.)
- [33] 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*.)
- [34] 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.

[35] Fisch, A., Nikitzuk, 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.

[36] Melli-Huber, J., Weinberg, B., Fisch, A., Nikitzuk, 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.

[37] 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.

[38] 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.

[39] 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.

[40] 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.

[41] 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.

[42] 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.)

[43] 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.

[44] 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.)

[45] 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.

- [46] 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.
- [47] 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.
- [48] Sommese, A.J., and Wampler, C.W., “Numerical algebraic geometry,” *Lectures in Applied Mathematics: The Mathematics of Numerical Analysis*, Vol. 32, American Mathematical Society, Providence, R.I., 1996, pp. 749–763.
- [49] 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.
- [50] 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.
- [51] 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.
- [52] 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.
- [53] Wampler, C.W., “An efficient start system for multi-homogeneous polynomial continuation,” *Numerische Mathematik*, Vol. 66, 1994, pp. 517–523.
- [54] 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.
- [55] Wampler, C.W., “Type synthesis of mechanisms for variable valve actuation,” SAE technical paper 930818, March 1993.
- [56] 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.
- [57] Wampler, C.W., “Bezout number calculations for multi-homogeneous polynomial systems,” *Applied Mathematics and Computation*, Vol. 51, 1992, pp. 143–157.
- [58] 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.
- [59] 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.

- [60] 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.
- [61] 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.
- [62] 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.
- [63] Morgan, A.P., Sommese, A.J., and Wampler, C.W., "Computing singular solutions to nonlinear analytic systems," *Numerische Mathematik*, Vol. 58, 1991, pp. 669–684.
- [64] 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.
- [65] 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.
- [66] 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.
- [67] 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.
- [68] 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.
- [69] 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.
- [69] 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.)
- [70] 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.
- [71] 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.

- [72] 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.)
- [73] 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.
- [74] 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.
- [75] 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.
- [76] 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.
- [77] 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.
- [78] 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.
- [79] 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.