

Discussiones Mathematicae
Probability and Statistics 31 (2011) 59–61
doi:10.7151/dmps.1136

ON THE OPTIMAL CONTINUOUS EXPERIMENTAL DESIGN PROBLEM

CHRISTOS P. KITSOS

Technological Educational Institute of Athens
Department of Mathematics
12210 Egaleo, Athens, Greece
e-mail: xkitsos@teiath.gr

Abstract

The target of this paper is to provide a compact review of the Optimal Experimental Design, the continuous case. Therefore we are referring to the general nonlinear problem in comparison to the linear one.

Keywords: nonlinear experimental design, static, sequential design.

2010 Mathematics Subject Classification: 62K05, 62L05, 62F25.

REFERENCES

- [1] K.M. Abdelbasit and R.L. Plackett, *Experimental design for binary data*, JASA **78** (1983) 90–98. doi:10.1080/01621459.1983.10477936
- [2] A.C. Atkinson and A.N. Donev, *Optimum Experimental Designs* (Clarendon Press, Oxford, 1992).
- [3] D.M. Bates and D.G. Watts, *Relative curvature measures of nonlinearity*, JRSSB **42** (1980) 1–25.
- [4] E.M.L. Beale, *Confidence regions in non-linear estimation*, JRSSB **22** (1960) 41–88.
- [5] G. Elfving, *Optimum allocation in linear regression theory*, Ann. Math. Stat. **23** (1952) 255–262. doi:10.1214/aoms/1177729442
- [6] V.V. Fedorov, *Theory of Optimal Experiments* (Academic Press, 1972).
- [7] R.A. Fisher, *On the mathematical foundation of theoretical statistics*, Phil. Trans. Roy. Soc. London (Ser. A) **22** (1922) 309–368.
- [8] I. Ford, C.P. Kitsos and D.M. Titterton, *Recent advances in nonlinear experimental design*, Technometrics **31** (1989) 49–60. doi:10.1080/00401706.1989.10488475

- [9] I. Ford, D.M. Titterington and C.F.J. Wu, *Inference and sequential design*, Biometrika **72** (1985) 545–551. doi:10.1093/biomet/72.3.545
- [10] F.E. Fornius, Optimal Design of Experiments for the Quadratic Logistic Model (PhD Thesis, Stockholm University, Sweden, 2008).
- [11] D.C Hamilton, D.G. Watts and D.M. Bates, *Accounting for intrinsic nonlinearity in nonlinear regression parameter inference regions*, Ann. Stat. **10** (1982) 386–393. doi:10.1214/aos/1176345780
- [12] P.D.H. Hill, *D-optimal designs for partially nonlinear regression models*, Technometrics **22** (1980) 275–276. doi:10.1080/00401706.1980.10486145
- [13] P.D.H. Hill, Optimal Experimental Design for Model Discrimination (PhD Thesis, University of Glasgow, UK, 1976).
- [14] S. Karlin and W.J. Studden, *Optimal experimental designs*, Ann. Math. Stat. **37** (1966) 783–815. doi:10.1214/aoms/1177699361
- [15] A.I. Khuri, *A note on D-optimal designs for partially nonlinear regression models*, Technometrics **26** (1984) 59–61.
- [16] J. Kiefer, *General equivalence theory for optimum designs (approximate theory)*, Ann. Stat. **2** (1974) 849–879. doi:10.1214/aos/1176342810
- [17] J. Kiefer and J. Wolfowitz, *The equivalence of two extreme problems*, Canadian J. Math. **12** (1960) 363–366. doi:10.4153/CJM-1960-030-4
- [18] C.P. Kitsos, *Invariant canonical form for the multiple logistic regression*, Math. in Eng. Science and Aerospace (MESA) **2(3)** (2011) 267–275.
- [19] C.P. Kitsos, *Design aspects for the Michaelis-Menten model*, Biometrical Letters **38** (2001) 53–66.
- [20] C.P. Kitsos, *Fully sequential procedures in nonlinear design problems*, Comp. Stat. and Data Analysis **8** (1989) 13–19. doi:10.1016/0167-9473(89)90061-3
- [21] C.P. Kitsos, Design and Inference in Nonlinear Problems (PhD Thesis, University of Glasgow, UK, 1986).
- [22] C.P. Kitsos and K.G. Kolovos, *An optimal calibration design for pH meters*, Instrumentation Science and Technology **38(6)** (2010) 436–447. doi:10.1080/10739149.2010.514158
- [23] E. Lauter, *A method of designing experiments for nonlinear models*, Math. Operationsforsch. U. Stat. **5** (1974) 697–708.
- [24] F. Pukeisheim and D.M. Titterington, *General differential and Lagrangian theory for optimal experiment design*, Ann. Stat. **11** (1983) 1060–1068.
- [25] R. Sibson, *Discussion of paper by H.P. Wynn*, JRSSB **34** (1972) 181–183.
- [26] S.D. Silvey, *Discussion of paper by H.P. Wynn*, JRSSB **34** (1972) 174–175.
- [27] S.D. Silvey, Optimal Design (Chapman and Hall, 1980). doi:10.1007/978-94-009-5912-5

- [28] S.D. Silvey and D.M. Tittertington, *A geometric approach to optimal design theory*, Biometrika **60** (1973) 21–32. doi:10.1093/biomet/60.1.21
- [29] K. Smith, *On the standard deviation of adjusted and interpolated values of an observed polynomial function and its constants and the guidance they give towards a proper choice of the distribution of observations*, Biometrika **12** (1918) 1–85.
- [30] M. Stone and J.A. Morris (1985), *Explanatory studies in non-sequential non-local non-linear design*, J. of Statistical Planning and Inference **12** (1985) 1–9. doi:10.1016/0378-3758(85)90048-5
- [31] D.M. Titterington, *Aspects of optimal design in dynamic systems*, Technometrics **22** (1980) 287–299. doi:10.1080/00401706.1980.10486160
- [32] D.M. Titterington, *Optimal design: Some geometrical aspects of D-optimality*, Biometrika **62** (1975) 313–320.
- [33] L.V. White, *An extension to the general equivalence theorem for nonlinear models*, Biometrika **60** (1973) 345–348. doi:10.1093/biomet/60.2.345
- [34] C.F.J. Wu, *Asymptotic theory of nonlinear least squares estimates*, Ann. Stat. **9** (1981) 501–513. doi:10.1214/aos/1176345455
- [35] C.F.J. Wu and H.P. Wynn, *The convergence of general step-length algorithms for regular optimum design criteria*, Ann. Stat. **6** (1978) 1273–1285. doi:10.1214/aos/1176344373
- [36] V. Zarikas, V. Gikas and C.P. Kitsos, *Evaluation of the optimal design cosinor model for enhancing the potential of robotic theodolite kinematic observation*, Measurement **43(10)** (2010) 1416–1424. doi:10.1016/j.measurement.2010.08.006

Received 18 May 2011

