



HAL
open science

On the ill-posedness of observation problems

Sette Diop

► **To cite this version:**

Sette Diop. On the ill-posedness of observation problems. International Workshop on Mathematical Modelling and Scientific Computations - MMSC'09, Sep 2009, Velingrad, Bulgaria. hal-00828595

HAL Id: hal-00828595

<https://centralesupelec.hal.science/hal-00828595>

Submitted on 31 May 2013

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

On the ill-posedness of observation problems

S. Diop

Laboratoire des Signaux & Systèmes
Supélec, Plateau de Moulon
91192 Gif sur Yvette cedex, France
diop@lss.supelec.fr

Abstract. We call observation problems the estimation of state variables (or more generally, internal variables) from two sources of information: on-line measurements of some variables and the dynamic model relating the quantities to be estimated and the measurements. In the control theory engineering literature the tremendous success of the Kalman filter has left little room to numerical analysis approaches to observation problems. This work is a contribution to the building of a tunnel between numerical analysis and engineering literature on observation problems. The first brick is seen to be the statement that state estimation is an ill-posed inverse problem. This is the aim of the present communication. More precisely, we restrict ourselves to linear systems (not necessarily with constant coefficients).

Keywords. Observer design; State estimation; Ill-posed inverse problems

References

- [1] L. Blank, State estimation analysed as inverse problem, in R. Findeisen, F. Allgöwer, L. Biegler (eds.), *International Workshop on Assessment and Future Directions of Nonlinear Model Predictive Control, Freudenstadt-Lauterbad, Germany, 2005*, volume 358 of *Lect. Notes Control Inform. Sci.*, Springer-Verlag, Berlin, 2007, pp. 335–346.
- [2] S. Diop, V. Fromion, J. W. Grizzle, A global exponential observer based on numerical differentiation, in *Proceedings of the IEEE Conference on Decision and Control*, IEEE Press, New York, 2001, Paper CD012047.
- [3] A. Mhamdi, W. Marquardt, A regularization approach to estimation using observers, in *Proceedings of the American Control Conference*, volume 6, American Automatic Control Council, Evanston, IL, 2001, pp. 4228–4233 (Paper 762 on CD).