Book Review

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Nonlinear System Identification: NARMAX Methods in the Time, Frequency, and Spatio-Temporal Domains'
by Stephen A. Billings
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This book presents a refreshingly new approach to system identification with methods of building models that are simple and intuitive, which allow the models to be written down and related to the system, and model validation methods. The book covers the following major points.

- The analysis of models in the frequency domain – no one else can do this and it is really important to look at frequency domain behaviour.
- Fitting continuous time models without computing derivatives which would induce real problems with the noise.
- Tracking not just slow but very rapid time variations and mapping these to frequency responses.
- Modelling based on wavelet models where the advantage is that wavelets have been proved to have the very best approximation properties.
- A new theory to identify and model sub harmonic and chaotic systems based in both time and frequency.
- For the first time, a comprehensive theory to identify spatio-temporal models based on cellular automata and coupled map lattice models, including the identification of pde models where there is no a priori information or assumptions.
- Importantly numerous real applications are included in the case studies from hysteretic systems, fruit fly visual systems, space weather, robotics, etc.

In summary, this book helps practitioners and researchers find ways to solve difficult non-linear system identification problems using the well-established NARMAX method. It is a description of a class of system identification algorithms that can be used to identify non-linear dynamic models from recorded data. Written with an emphasis on making algorithms and methods accessible so that they can be applied and used in practice, this book also addresses frequency and spatio-temporal methods rarely covered elsewhere, and which can provide significant insights into complex system behaviour.

I recommend the book for widespread readership, including anyone who has data and wants to fit a dynamic model, from almost all scientific and engineering disciplines – see the examples under chapter 14 for the breadth of potential subject application areas.