ON THE IDENTIFICATION OF MODEL STRUCTURE IN HYDROLOGICAL
AND ENVIRONMENTAL SYSTEMS

Z. Lin
Department of Crop and Soil Sciences, University of Georgia, Athens, Georgia, USA

M. B. Beck
Warnell School of Forest Resources, University of Georgia, Athens, Georgia, USA

The paper presents a new recursive estimation algorithm designed expressly for the
purpose of model structure identification — not for state estimation or primarily for
parameter estimation — and discusses two applications thereof: one to a motivating,
hypothetical example; and one to data from whole-pond manipulations designed to
explore sediment-nutrient-phytoplankton dynamics. The algorithm is the current
culmination of a long-term technical development: from state estimation using a Kalman
filter; through state-parameter estimation using an extended Kalman filter; through a
Recursive Prediction Error (RPE) algorithm for parameter estimation cast in the state-
space and recently modified for estimating time-varying model parameters; to an RPE
algorithm for estimating time-varying parameters, but cast in a parameter-space
formulation. It is concluded that the algorithm performs well, in the sense of being robust
and indeed in revealing specifically where — but less so, exactly how — a prior,
candidate model’s structure may be in error.