Proceedings of the 1983
Winter Simulation Conference
S. Roberts, J. Banks, B. Schmeiser (eds.)

345

THE INITIAL TRANSIENT PROBLEM -- ESTIMATING TRANSIENT AND STEADY STATE PERFORMANCE

S. J. Deutsch
School of Industrial
and Systems Engineering
Georgia Institute of
Technology
Atlanta, GA 30332

J. E. Richards
Department of Industrial
Engineering and Operations
Research
N.C. State University
Raleigh, NC 27650

C. Fernandez-Torres
Graduate Program in
Operations Research
N.C. State University
Raleigh, NC 27650

RESEARCH SUMMARY

Deutsch and Richards (1983a,b,d,e) have derived the following consequences of ignoring initial transients in time series. The variance and autocovariance estimators are biased. As a result, the autocovariance and therefore autocorrelation functions may incorrectly represent the ARMA model, lead to model identification errors, and further bias variance and steady state expected value estimators. However, using transient data for steady state estimation is more economical than approaches which throw away transient observations (Deutsch and Richards 1983c,f).

In this paper, Deutsch, Richards and Fernandez-Torres (1983) fit relaxed time series (RARMA) models to transient and steady state data from a simulated M/M/1 queue and a nonstationary queueing network. Both systems are initially empty and idle. The statistical identification procedure (Richards 1983) for the RARMA model class is illustrated. Improved estimates of the steady state mean of the M/M/1, and of the polynominal in time of the network's nonstationary "steady state" performance, are obtained by including the identified transient model in the RARMA regression.

REFERENCES

Deutsch S.J., Richards J.E. (1983a), "ARMA Model Identification in the Presence of a Solitary Aberration", working paper, Department of Industrial Engineering, North Carolina State University, Raleigh, NC 27650.

Deutsch S.J., Richards J.E. (1983b), "ARMA Model Identification in the Presence of Multiple Aberrations and Transients", working paper, Department of Industrial Engineering, North Carolina State University, Raleigh, NC 27650.

Deutsch S.J., Richards J.E. (1983c), "Economic Considerations in Estimating Steady State in Stochastic System Simulation", working paper, Department of Industrial Engineering, North Carolina State University, Raleigh, NC 27650.

Deutsch S.J., Richards J.E. (1983d), "Sample Properties of Autocovariance Function Estimates in Time Series Subject to Interdependent Outliers or Transients", working paper, Department of Industrial Engineering, North Carolina State University, Raleigh, NC 27650.

Deutsch S.J., Richards J.E. (1983e), "Sample
    Variance Consequences of Modeling Transient
    Time Series as Stationary ARMA Processes",
    working paper, Department of Industrial
    Engineering, North Carolina State University,
    Raleigh, NC 27650.

Deutsch S.J., Richards J.E. (1983f), "Steady
    State Estimation in Stochastic System
    Simulation", working paper, Department of
    Industrial Engineering, North Carolina State
    University, Raleigh, NC 27650.

Deutsch S.J., Richards J.E., Fernandez-Torres C.
    (1983), "Estimating Transient and Steady
    State Performance in Queueing Simulations",
    working paper, Department of Industrial
    Engineering, North Carolina State University,
    Raleigh, NC 27650.

Richards J.E. (1983), Minimizing Run Length in
    Simulations Subject to Initial Transients,
    unpublished Ph.D. thesis, School of
    Industrial and Systems Engineering, Georgia
    Institute of Technology, Atlanta, GA 30332.