

ASSESSING ACCEPTABILITY OF SIMULATION STUDIES

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ABSTRACT: The process of assessing acceptability of simulation studies has many aspects. Recently a comprehensive framework has been developed to systematize relevant criteria and assessment problems. The highlights of the framework are given in this paper.

1. INTRODUCTION

A framework has been developed to systematize the criteria and problems associated with the assessment of the acceptability of simulation studies (Ören 80). The full paper will be published in the Communications of the ACM in early 1981. Since the article is not yet published, it was not possible to reprint it from CACM. However, both the editor-in-chief of the CACM and the editor of the special issue of the CACM kindly granted the permission to publish an abridged version of the paper to present the highlights of the framework.

2. PROBLEM AND ITS PARTITIONING

To partition the problem of the acceptability of a simulation study one can consider 1) components of a simulation study, 2) a set of relevant criteria, and 3) the acceptability problems of each component of a simulation study with respect to certain of the relevant criteria.

So far as the components of a simulation study are concerned, one can identify 1) simulation results, 2) data (real-world data and simulated data), 3) model (parametric model and values of the parameters), 4) experimentation specification (experimental frame and simulation runs), 5) computer program (representation and execution), and 6) methodologies and techniques used (modelling, experimentation, simulation, and programming.)

The criteria to be used for assessing acceptability of simulation studies can be grouped in six categories: 1) the goal of the study, 2) the real-system (structure and data), 3) the specific model (parametric model and model parameter set), 4) another model, 5) experimentation specification, and norms of: modelling methodology, experimentation technique, simulation methodology, and software engineering.

The acceptability problems of simulation results with respect to the goal of the study are enumerated in Table 1. The list of acceptability problems of data is given in Table 2. The list of problems in acceptability of models is given in Table 3. Problems of acceptability of experimentation specification are listed in Table 4. The groups of problems of acceptability of programs are highlighted in Table 5. The groups of problems of the acceptability of methodologies or techniques used in a study are highlighted in Table 6. For further details and additional references (over sixty) the reader is referred to the article in CACM.

REFERENCE

Ören, T.I. (1980), Concepts and criteria to assess acceptability of simulation studies: A frame of reference, Technical Report TR 80.03, Computer Science Department, University of Ottawa, 51 p. (Will be published in the Communications of the ACM)

Table 1

Acceptability of simulation results with respect to the goal of the study:

- Evaluation of the recommendations of the study
 - Acceptability of the study
 - Credibility of the study
 - Cost-effectiveness of the study
 - Timeliness of the recommendations
 - Comprehensibility of the recommendations
 - Documentation of the study
 - Applicability of the recommendations
 - Scope of the study
 - Sensitivity of the recommendation
 - Utility of the study
(Usefulness of the study)
 - Certification of the simulation study

Table 2

Acceptability of real-system data

Acceptability of real-system data with respect to the goal of the study:

- Relevance of real-system data
- Existence of qualitative data

Acceptability of real-system data with respect to the norms of experimentation technique:

- Assessing the measurement noise

Acceptability of simulated data

Acceptability of simulated data with respect to the real-system data collected under similar conditions:

- Applicability of validation
- Model validity
 - Replicative validity of a model
 - Predictive validity of a model

Acceptability of simulated data with respect to experimentation specification (without reference to real-system data):

- Internal validity of a model

Table 3

Acceptability of a model

- Model certification

Acceptability of a model with regard to the goal of the study

- Model relevance
 - Domain of intended application
 - Range of applicability of a model
- Model useability
 - Model referability
 - Model modifiability
- Model comprehensibility
 - Model documentation
- Acceptability of a model with respect to its technical system specification

Acceptability of a model with respect to the real-system structure

- Structure identification
- Model validity
 - Structural validity of a model
- Algorithmic analysis of the concordance of units

Acceptability of a model with respect to another model:

- In Model transformation
 - Validity of model simplification
 - Approximation in model simplification
 - Validity of model elaboration
 - Approximation in model elaboration
 - Validity of renaming descriptive variables
- In model comparison
 - Model homomorphism
 - Model isomorphism
 - Model equivalencing

Acceptability of a model with respect to the modelling formalism:

- Model consistency
(Mathematical correctness of the specification of a model)
- Model robustness

Acceptability of the parameters of a model with respect to the real system:

- Model fitting
- Model calibration
- Model identification

Table 4

Acceptability of experimentation specification with respect to the goal of the study:

- Relevance of the objective function of the study
 - Measure of performance
 - Figure of merit
- Determination of the data collection time period
 - to study transient behaviour
 - to study steady-state behaviour
- Determination of the run length
- Determination of number of simulation runs

Acceptability of experimentaiton specification with respect to a specific model:

- Applicability of an experimental frame to a model
- Comparison of experimental frames

Acceptability of experimentation specification with respect to the norms of experimentation techniques

- Evaluation of experimental design

Table 5

Acceptability of program with respect to the simulation study

- Specification of a specific model
 - parametric model
 - Set of values of model parameters
- Specification of the experimentation
 - experimental frame
 - simulation study

Acceptability of program with respect to the norms of software engineering:

- Program referability
- Program reliability
- Program efficiency

Table 6

Acceptability of modelling methodology used

- with respect to the norms of modelling methodology
- with respect to the norms of software engineering

Acceptability of experimentation technique used

- with respect to the norms of simulation methodology

Acceptability of programming technique used

- with respect to the norms of software engineering