Working Group Round Robin Decision Analysis Working Group (DAWG)

2021
Annual **INCOSE**
international workshop
Virtual Event
January 29 - 31, 2021

Leadership Team:

- Frank Salvatore, SAIC — Chair — frank.salvatore@saic.com
- Dr. Greg Parnell, University of Arkansas — Co Chair — gparnell@uark.edu
- Dr. Tracee Gilbert, System Innovation — Co Chair — tracee.gilbert@systeminnovation1.com
- Dr. Tyesia Alexander, SAIC — Co Chair — tyesia.p.alexander@saic.com

Members: 116

Addresses: https://connect.incose.org/WorkingGroups/DecisionAnalysis
http://www.incose.org/ChaptersGroups/WorkingGroups/analytic/decision-analysis

www.incose.org/IW2021

MBSE Capabilities to Enable Trade-off Analyses

Capability	Required	Desired	Illustrated in Case Study
Stakeholder Requirements	In current MBSE tools		In MODA model
System Requirements	In current MBSE tools		In performance and effectiveness models
Define and describe systems alternatives	Discrete alternatives	Continuous design parameters	Generate designs using Monte Carlo simulation
Modeling Environment Enabling Custom Modules	Incorporate user defined modules for a variety of analysis uses		Use ModelCenter with custom Java and Python modules
Integrated Models	Use integrated models to automate the evaluation of system alternatives and exploration of the decision tradespace.		Integrate performance, effectiveness, value, and cost models
System Performance Models	Determine if alternatives meet the system requirements (measures of performance)	Varying fidelity and multiresolution modeling.	Model UAV system and a sensor performance in various operating environments
Ility Models	Perform ility calculations for the alternative system designs		Not implicitly modeled, use parameter inputs
System Effectiveness Models	Determine if alternatives meet the stakeholder requirements (measures of effectiveness)	Include ilities data used the mission chain analysis of system alternatives.	Use integrated multiobjective value model to measure system effectiveness
LCC Model	Calculate the LCC of each alternative	Include ilities data in the LCC model.	Use an integrated cost model
MODA Value Model	Calculate the stakeholder value using multiple effectiveness measures of each alternative		Use an integrated multiobjective value model to measure system effectiveness
Engineering Economic Analysis Models	Perform economic analysis of design alternatives.		Not done.
Quantify Uncertainty	Put distributions on inputs and perform Monte Carlo Simulation on outputs		Use Monte Carlo simulation
Tradespace Visualization	Provide performance, effectiveness, stakeholder value, and cost data that can be used to visualize the tradespace in another software	Provide GUI for tradespace visualization	Produce outputs allowing for trade-off analysis of Stakeholder Value and LCC
Pareto Optimal Solutions	Incorporate algorithms to identify Pareto Optimal designs	Evaluate design sets using SBD	Pareto optimal solutions identified during tradespace analysis

Parnell, G. S., Shallcross, N. J., Specking, E., Pohl, E., and Phillips, M., Role of Decision Analysis in MBSE, **Handbook of Model-Based Systems Engineering**, Springer, Madni, A. and Augustine, N. Editors, awaiting publication.

Please send feedback to gparnell@uark.edu

DAWG MBSE items to work

- Delivered 4 presentations at IW2021

- Increase awareness of the practice / presentations, meetings

- Look for examples and share them (e.g. cube sat)

- Review OMG spec on decision modeling notation (DMN). What capabilities does it cover?

- How well does SysML v2 cover the identified MBSE capabilities?

- Look into how the use of model patterns (JPL)/test harness can be applied. How could decision analysis be used to help understand the completeness/readiness etc. of the program including application of model based activities.

- Creating a decision analysis ontology

- Learn more about how decisions are incorporated into modeling efforts

- Identify Decision Analysis Digital Artifacts. All working groups should be doing this. We need an accepted list.

2021
Annual **INCOSE**
international workshop
Virtual Event
January 29 - 31, 2021

www.incose.org/IW2021