2026 Annual Modeling and Simulation Conference (ANNSIM'26)

Simulation Series Volume 58 Number 1

Orlando, Florida, USA
4 - 7 May 2026

Part 1 of 2

ISBN: 979-8-3313-4024-7

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571
www.proceedings.com



Some format issues inherent in the e-media version may also appear in this print version.

© 2026 SIMULATION COUNCILS, INC.

Responsibility for the accuracy of all statement in each paper rests solely with the author(s). Statements are not necessarily representative of, nor endorsed by, The Society for Modeling and Simulation International.

Printed with permission by Curran Associates, Inc. (2026)

Permission is granted to photocopy portions of this publication for personal use and for the use of students provided credit is given to the conference and publication. Permission does not extend to other types of reproduction nor to copying for incorporation into commercial advertising nor for any other profit-making purpose. Other publications are encouraged to include 300- to 500-word abstracts or excerpts from any paper contained in this book, provided credits are given to the author and the conference. For permission to publish a complete paper write: The Society for Modeling and Simulation International (SCS), 2598 Fortune Way, Suite I, San Diego, CA 92081, USA.

Additional copies of the Proceedings are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571
curran@proceedings.com
www.proceedings.com/0128.html

or

The Society for Modeling
and Simulation International
11315 Rancho Bernardo Road, Suite 139
San Diego, CA 92127 USA
www.scs.org

ISBN: 979-8-3313-4024-7
PRINTED IN THE UNITED STATES

TABLE OF CONTENTS

PART 1

MACHINE LEARNING MODELS FOR VIDEO STREAMING QUALITY OF EXPERIENCE PREDICTION FROM WIRELESS TRANSMISSION PARAMETERS 1
A. Al-Habashna, A. Iqbal, G. Wainer

HLA 4 FEDERATE PROTOCOL PERFORMANCE EVALUATION: FIRST RESULTS 13
F. Morlang, S. Strassburger

ASSESSING EMERGENT BEHAVIOR USING ENTROPY IN AGENT-BASED MODELING AND SIMULATION OF AUTONOMOUS SWARM SYSTEMS 22
B. Gumahad, A.J. Collins

INCLUDING SOCIAL BEHAVIOR IN DEMAND FORECASTS CHANGES REGIONAL ELECTRICITY INFRASTRUCTURE INVESTMENT: INSIGHTS FROM AN AUSTRALIAN MICROGRID CASE STUDY 34
B. Hofmann, R. Vidanaarachchi, M. Shaw

DEVS-VIT: A DEVS SIMULATION-BASED EXPLAINABILITY APPROACH FOR VISION TRANSFORMERS 47
H.P. Hy, A. Ayadi, C. Frydman

DEVELOPING A DISCRETE-EVENT SIMULATOR OF SCHOOL SHOOTER BEHAVIOR FROM VR DATA 60
C.A. McClurg, A.R. Wagner

ADVERSARIAL MIMICRY AND MASKING IN ISOLATION FOREST ANOMALY DETECTION SYSTEMS 73
C. Worrell, K. Kurian

DIGITAL TWIN-DRIVEN OPTIMIZATION OF HUMANITARIAN LOGISTICS USING DYNAMIC VEHICLE-DRONE ROUTING 85
A.A.B. Abdelnabi, G. Rabadi

A DUAL-GRAPH SIMULATION TESTBED FOR AUTONOMOUS SWARMS OF OTHER-WORLD LANDERS 98
D.J. Berndt

EXPLAINABLE SIMULATION OF A SURGICAL TRAINING SYSTEM: A CAST-INSPIRED CASE STUDY 111
A. Lektauers, T.M. Wilson, J.W. Rozenblit

VIRTUAL REALITY TRAINING SIMULATOR FOR PERCUTANEOUS NEEDLE-BASED INTERVENTIONS WITH HAPTIC FEEDBACK 123
N. Bertholon, C. Martin, E. Pernod, H. Courtecuisse

DECENTRALIZED ROW ALLOCATION FOR HARVESTING ROBOTS WITH UNCERTAIN HARVESTING SPEEDS IN AN ACTOR-CRITIC STRUCTURE 136
M. Alsayegh, Y. Xu

AN AGENTIC RAG SYSTEM FOR MULTI-COURSE SUPPORT IN MODELING AND SIMULATION EDUCATION 148
Y. Li, Y. Shen, M. Sosonkina, J.F. Leathrum

VIRTUAL POINT OF INTEREST-BASED OPERATIONAL SPACE CONTROL FOR DUAL-ARM AERIAL MANIPULATORS 161
J. Varela-Aldas, A. Quito, B.S. Guevara

DEVSFORGE: A VISUAL MODELING ENVIRONMENT FOR XDEVS 174
L. Almendras, D. Muniz-Zurrunero, R. Cardenas, P. Arroba, J.L. Risco-Martin

GRAPH-BASED TRAVEL-TIME MODELING FOR HOSPITAL TRANSPORT SIMULATION 187
E. Ehsanfar

EXTENDING XDEVS NO_STD: REAL-TIME ASYNCHRONOUS DEVS FOR EMBEDDED CO-SIMULATION 200
D. Muniz-Zurrunero, R. Cardenas, P. Arroba, J.L. Risco-Martin

A CROSS-REALITY, SPATIAL-AUDIO TESTBED: DEVELOPMENT AND APPLICATIONS FOR SIMULATIONS 213
G. Luna, C. Maraj, J. Hurter, K. Fernandez, I.B. Moreno

LC-VSTP: LIDAR-CAMERA FUSED VIRTUAL SURGERY TRAINING PLATFORM 225
J. Tang, L. Guo, Y. Nan, T.M. Wilson, S. Cao, H. Xu, J. Rozenblit

AIMHEI: AN AI-POWERED SYSTEM FOR AUTOMATED ASSESSMENT OF CLINICAL INTERVIEW COMPETENCIES 238
K. McLemore, R. Delfs, A. Molzahn, S. Walter, C. Keegan, M. Demer, D. Biffar, A. Hamilton

REAL-TIME SUTURE QUALITY ASSESSMENT USING YOLOV8 FOR SURGICAL SKILLS TRAINING IN MEDICAL EDUCATION 250
R. Delfs, K. McLemore, S. Walter, M. Demer, C. Keegan, D. Biffar, A. Hamilton

SIMULATION-BASED SAFETY SCREENING OF REINFORCEMENT LEARNING ENABLED DRIVING CONTROLLERS USING LOW-FIDELITY MODELS 261
S. Jain, K. Arora, D. Sharma, J.A. Tanuwijaya, A. Mukherjee, B. Akbas, M.I. Akbas

RULE-LEVEL REASONING FOR PERFORMANCE-AWARE FLOORPLAN GENERATION: INTEGRATING SHAPE GRAMMARS WITH DAYLIGHT SIMULATION 274
Y. Shi, A. Economou, P. Kastner

CONTINUAL LEARNING WITH ROLLING-WINDOW RESAMPLING FOR ONLINE SIMULATION SYSTEMS 287
T. Wright, A. Seo, B. Soykan, S. Mondesier

LLM-DRIVEN VIRTUAL PATIENT SIMULATION WITH DIALOGUE, PHYSICAL EXAM, AND COMPREHENSIVE INTERACTION LOGGING FOR CLINICAL TRAINING 300
S. Walter, R. Delfs, K. McLemore, M. Demer, C. Keegan, D. Biffar, A. Hamilton

USING HIGH-FIDELITY HUMAN BODY SIMULATION MODELS TO CREATE SURROGATES FOR TRUSTED AUTONOMOUS CASUALTY EVACUATION 313
N. Davis, T. Bentley, A. Tolk

MULTI-OBJECTIVE REWARD SHAPING FOR AUTONOMOUS GROUND VEHICLE CONTROL IN ADVERSARIAL SIMULATIONS 325
B. Soykan, G. Rabadi, G. Bochenek, V.J. Paul

HEURISTIC FAILURE DETECTION IN DEVS-BASED SUPERVISORY CONTROLLER 338
M. Murillo, G. Wainer, B. Earle, H. Griffith, I. Borshchova

EVALUATING SYSTEM DESIGN DECISIONS OF AUTONOMOUS TRANSPORTATION SYSTEMS IN HOSPITAL LOGISTICS USING AGENT-BASED SIMULATION 350
A. Hess, D. Stampa

A REAL-TIME HAPTICS-DRIVEN VIRTUAL REALITY-BASED BIOMECHANICS SIMULATION ARCHITECTURE FOR OBSTETRICS TRAINING 363
M.N. Saquib, A. Ravangard, A. Tapp, O. Kravchenko, S. Nasrallah, M. Audette

A COMPARATIVE STUDY ON THE ENERGY PERFORMANCE OF KINETIC FAÇADES UNDER VARIOUS CLIMATES 374
C. Wu, C. Timmerman

COMBATENV: A GYMNASIUM-COMPLIANT SIMULATION FRAMEWORK FOR ADVERSARIAL STRESS-TESTING OF AUTONOMOUS CONTROL LOGIC 387
B. Soykan, G. Rabadi, G. Bochenek

SCENARIO VISUALIZATION TOOLKIT: PROVIDING EXPLANATIONS AND INTERPRETATIONS FOR SIMULATION TEST DATA 400
Q. Goss, M.I. Akbas

SIMULATION-DRIVEN XGBOOST MODEL FOR MULTI-OUTPUT BUILDING FACADE PERFORMANCE PREDICTION 412
E.I. Aghimien, A. Aksamija

TOWARDS REAL-TIME CYBERWARFARE SIMULATION: A HIGH-EFFICIENCY HEURISTIC FOR BUDGET-CONSTRAINED ATTACK INTERDICTION 425
J. Shin, L.R. Carley, K.M. Carley

BEYOND CORRIDOR AVERAGES: LANE-LEVEL VALIDATION OF MICROSCOPIC FREEWAY SIMULATION WITH EMPIRICALLY PARAMETERIZED ARRIVALS 438
K.R. Bishi, C. Bowman, J.A. Miller

DIFFICULTY- AND COHORT-INFORMED PRIORS FOR INDIVIDUALIZED NEXT-EXERCISE PERFORMANCE PREDICTION IN AN INTELLIGENT TUTORING SYSTEM 451
S. Mondesire, B. Soykan

PREDICTIVE DIGITAL TWIN FOR EMERGENCY EVACUATION: BAYESIAN STATE ESTIMATION AND CLOSED-LOOP CONTROL UNDER UNCERTAINTY 464
B. Soykan, G. Rabadi

DIFFERENTIABLE AGENT-BASED MODELING FOR MULTI-ECHELON SUPPLY CHAINS: GRADIENT-BASED OPTIMIZATION OF HETEROGENEOUS POLICIES AT SCALE 478
B. Soykan, M. Alsayegh, S. Mondesire, G. Rabadi

DATA-DRIVEN EXTRACTION OF AGENT-BASED MODEL COMPONENTS FROM EVENT LOGS USING CLUSTERING AND PROCESS MINING WITH STOCHASTIC PETRI NETS 491
H.M. Lee, S. Lazarova-Molnar

PART 2

CURRICULUM-BASED REINFORCEMENT LEARNING FOR FIRE EVACUATION SIMULATION IN COMPLEX INDOOR ENVIRONMENTS 504
G. Han, K. Cho, Y. Eum, Y. Song, A.J. Park, S.H. Cha

A DATA-DRIVEN DIGITAL TWIN ARCHITECTURE FOR AN ELECTRIC ARC FURNACE USING LSTM-BASED REDUCED-ORDER MODEL AND DISTRIBUTED SIMULATION 516
M. El Haddad, J. Possik, C. Yaacoub

EXPLORING EXTENDED REALITY USE CASES FOR VISUALISING ROAD FREIGHT DECARBONISATION USING DIGITAL TWINS 531
A. Goodsell, D. Mitchell, X. Na, P. Greening, D. Flynn

AN AGENT-BASED MODEL FOR EVALUATING SURGICAL SITE INFECTION PREVENTION BUNDLE POLICIES IN COLORECTAL SURGERY 545
S.M. Sajjadi, V.G. Prabhu, N. Rohatgi, H. Takla, R. Morgan

MODELING INDIVIDUAL DIFFERENCES UNDERLYING HUMAN SCIENTIFIC REASONING PROCESSES IN GAME-BASED LEARNING ENVIRONMENTS 559
C. Marano, A. Brosnihan, S.V. Abrol, V.G. Prabhu, R. Azevedo

MODELING MISINFORMATION AS A COMMONS PROBLEM 571
V. Malhotra

SCALABLE VALIDATION OF AUTONOMOUS COLLISION AVOIDANCE VIA TWO-TIER SIMULATION 585
J.A.G. Nunez, M.I. Akbas

TUTORIAL: PARTICLE FILTER-BASED DATA ASSIMILATION FOR DISCRETE EVENT SIMULATION 597
X. Hu

A GOVERNANCE-AWARE FRAMEWORK FOR LLM-DRIVEN SOFTWARE EVOLUTION, ATEAM 612
S. Vella, S. Sharieh, A. Ferworn, M. Sharieh

VDA: A VARIANCE DECOMPOSITION ANALYSIS FOR PARAMETER SCREENING BY SEPARATING SIGNAL AND STOCHASTICITY IN SIMULATIONS 625
K. Hu, M. Kapadia, V. Pavlovic, S. Yoon

ROBUST VERTIPORT CANDIDATE GENERATION UNDER DEMAND UNCERTAINTY USING IVAT-GUIDED FUZZY CLUSTERING 638
H.Z. Saghazadeh, S.E. Ghayoumabadi, S. Sabri

GEOMETRIC TRAJECTORY OPTIMIZATION FOR TRACON ARRIVALS: AN NLP APPROACH WITH ATC VECTORING MANEUVER MODELING 650
Y. Pang, D. Delahaye, J.P. Clarke

ARCHITECTURE-BASED GENERATION OF SIMULATION MODELS FOR IOT TWINS 664
Z. Zha, P. Mukherjee, S. Mustafiz

ATTSYNCBRIDGE: A DEVS PATTERN FOR STANDARDIZED DES–VR SYNCHRONIZATION VIA HLA 677
J. Jabbour, J. Possik, M. El Kassis, D. Kieken, C. Yaacoub, G. Zacharewicz

XR-NATIVE DIGITAL TWIN FOR SUBTRACTIVE MANUFACTURING MONITORING WITH AI-ENABLED HUMAN-IN-THE-LOOP ASSISTANCE 690
J. Panneerselvam, K. Mykoniatis, M. Pantelidakis

A SIMULATION FRAMEWORK FOR STUDYING COMMUNICATION TOPOLOGIES IN EDGE-ENABLED DISTRIBUTED DEEP LEARNING 703
J. Lopez, A. Abhari

BASAL STABILITY IN LEARNING SYSTEMS: A GRADIENT-BASED DIAGNOSTIC FOR RELIABILITY UNDER DISTRIBUTION SHIFT 715
M.B. Castaneda, D.G. Rabanal

KAN CONTROLS FOR DRIFT-ROBUST CONTINUAL INTRUSION DETECTION 728
E. Ostanin, N. Djosic, S. Sharieh, A. Ferworn

SIMULATION-ORIENTED GENERATIVE MODELING FOR DIGITAL TWINS VIA STRUCTURED TIMEGAN 741
W. Shabana, A. Abhari

AN AGENT-BASED MODEL OF EXPECTATIONS STATES THEORY IN A WELL-MIXED POPULATION 753
M.N. Zonouz

PRELIMINARY INVESTIGATION INTO THE ELECTRICAL IMPEDANCE OF A SIMPLIFIED MODEL OF A CHEMO-STRESSED CELLULAR MEMBRANE USING MOLECULAR DYNAMICS AND ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY 767
K.H. Tantawi, R. Alameddine, D. Alharthi, M. Colson, A. Adams

INFRASTRUCTURE MODERATION OF CROWDSOURCING EFFECTIVENESS IN HYBRID LAST-MILE DELIVERY SYSTEMS 780
M. Baniabdelnabi, A.B. Abdelnabi, G. Rabadi

MODELING EMERGENCY DEPARTMENT PHYSICIAN BURNOUT AND OPERATIONAL PERFORMANCE USING HYBRID SIMULATION 793
S.V.A. Neena, V.G. Prabhu

AN OPTIMIZATION–DRIVEN SIMULATION FRAMEWORK FOR DRONE–ASSISTED BLOOD DELIVERY IN HEALTHCARE LOGISTICS 806
M. Baniabdelnabi, A.B. Abdelnabi, G. Rabadi

EXPLAINABLE ANOMALY DETECTION IN COMPRESSOR SYSTEMS USING MULTI STREAM SENSOR ANALYSIS AND AUTOMATED MACHINE LEARNING 819
Nagarjun, G. Bhatia, N. Aref, R. Deshpande, J. Voelker, V.R. Hasti

ARTIFICIAL NEURAL NETWORK SURROGATE MODELING OF LAMINAR FLAME SPEED AND ADIABATIC FLAME TEMPERATURE OF HYDROGEN ENRICHED NATURAL GAS COMBUSTION FOR REAL-TIME DIGITAL TWIN APPLICATIONS 833
P.T. Serrano, G. Ramkissoon, V.R. Hasti

SIMULATION–BASED DEEP REINFORCEMENT LEARNING FOR FIXED–ROUTE TRUCK–DRONE DISPATCH PROBLEM 845
A.A.B. Abdelnabi, G. Rabadi

CRYPTOGRAPHIC AUTHENTICATION FOR UAV SWARM SECURITY: A COMPARATIVE ANALYSIS OF DETECTION METHODS AGAINST SPOOFING ATTACKS 860
S. Xing, J. Sammons, L.N. Kandel, S. Li, T. Yang

A SIMULATION FRAMEWORK FOR ROCKET-ENABLED HUMANITARIAN AID DELIVERY 872
M. Elkamel, C. Gray, C. Major, L. Rabelo

MODELING THE IMPACT OF TRANSPORT POLICIES ON OUT-OF-HOSPITAL CARDIAC ARREST SURVIVAL: A DISCRETE EVENTS SIMULATION APPROACH 884
S.S.W. Lam, H.M. Tan, A. Kumar, M.E.H. Ong

VISUALIZATION OF INTEGRATED FREIGHT MODES WITHIN FUTURE PORT OPERATIONS 896
D. Mitchell, A. Goodsell, N. Rehmatulla, D. Flynn

MODELLING AND PERFORMANCE EVALUATION OF SATELLITE ENABLED 5G/6G MULTICAST OVER TNAN 908
R. Paudyal, S. McRea, R. Upadhyay, A.N.B. Emran, L. Donnan, D. Wijesekera

CLIMATE-AWARE MODELING FOR ENERGY-EFFICIENT DATA CENTER WORKLOAD ROUTING 921
P.R.B. Balijepalli, V.R. Hasti

ENSEMBLE KALMAN FILTER-BASED DATA ASSIMILATION FOR WILDFIRE SPREAD SIMULATION 934
T. Imbesi, X. Hu

BENCHMARKING ALZHEIMER'S DISEASE CLASSIFICATION MODELS ACROSS COMBINED CLINICAL, NEUROIMAGING, AND BIOFLUID COHORTS 947
H. Mostaghimi, H.R. Okhravi, D.A. Cohen, B. Niknejad, M.A. Audette

A HIGH-FIDELITY SIMULATION FRAMEWORK FOR COMPUTER VISION-BASED TRANSFORMER OIL LEAK DETECTION 957
H. Premier, J. Naha, V.R. Hasti

SIMULATION DRIVEN SYNTHETIC DATA GENERATION FOR AI BASED CRACK DETECTION IN POWER TRANSFORMERS 970
F. Rahat, J. Naha, V.R. Hasti

SMART PRODUCT SERVICE SYSTEM: ENHANCING PROCESS VALUE MODELS THROUGH INCREMENTAL BPMN-TO-DEVS TRANSFORMATION 982
T. Alix, G. Zacharewicz, N. Daclin

OPTIMIZING BUILDING CODE COMPLIANCE CHECKING THROUGH SIMULATION AND LLMS 994
N. Mirhosseini, D. Shojaei, S. Sabri

Author Index