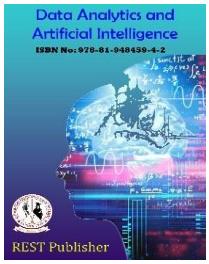
Data Analytics and Artificial Intelligence

Vol: 6(1), 2026

REST Publisher; ISBN: 978-81-948459-4-2

Website: http://restpublisher.com/book-series/daai/

DOI: https://doi.org/10.46632/daai/6/1/8



Statistical Normality and Reliability Analysis of Real-Time Performance Metrics in Hybrid Systems

***Sreedivya Sharma**

Staff Software Engineer, Walmart Labs, America

**Corresponding Author Email: sharmasreedivya@gmail.com*

Abstract: *The growing complexity of modern engineering and cyber-physical systems has revealed substantial limitations in traditional, standalone modeling and testing methods. Hybrid systems (HS), which integrate continuous and discrete dynamics, have become crucial for accurately representing the complex and interconnected behavior of real-world infrastructures. Persistent dependence on purely numerical or experimental approaches in high-risk fields such as power systems, embedded technologies, and structural engineering has proven inefficient and unreliable. Real-time hybrid simulation (RTHS) has emerged as an effective solution by integrating physical and computational components in real time, although its reliability is often affected by communication delays, actuator limitations, and stability challenges. Traditional testing methods, including shaking tables and pseudo-dynamic techniques, are constrained by scalability and their inability to capture rate-dependent behavior. Hybrid testing, combining simulation and physical experimentation, offers a practical alternative that remains underutilized.*

Key Words: *Real-time simulation, Hybrid dynamics. Cyber-physical systems, Discrete–continuous integration, Actuator control, Latency compensation, Stability analysis, Embedded systems, Sensor–actuator coordination, Real-time communication.*

1. INTRODUCTION

The term hybrid typically denotes a composition of elements with differing characteristics. In system theory, hybrid systems are characterized by behaviours that result from the combination of processes or components with distinct properties. More precisely, "hybrid" implies the integration of continuous and discrete elements. Therefore, a hybrid dynamical system is one whose behavior is governed by the interplay between continuous and discrete dynamics. [1] In conclusion, I will aim to situate Hybrid Systems (HS) within a broader framework by discussing recent trends and progress in fields such as computer science, artificial intelligence, robotics, and cognitive science. This perspective may reveal that the transition toward HS is more impactful than it might initially seem. Unlike some of the other presenters, I won't be sharing any new findings on HS since the announcement of this workshop, so my talk will remain entirely non-technical. Those who may find this less engaging are welcome to explore other presentations in the workshop. [2] Real-time hybrid simulation (RTHS) is an advanced technique for evaluating civil structures under dynamic conditions by separating the system into physical and numerical components. These components interact in real time, necessitating precise coordination of forces and motions at their interface. The effectiveness of RTHS largely depends on the chosen system partitioning and how well delays in communication, computation, and actuation are addressed. [3] To ensure reliable performance, robust actuator control and well-defined guidelines are essential—covering control specifications, sampling frequency, and strategies for mitigating instability. This study introduces a stability switch criterion to support the design of dependable and accurate RTHS experiments. [4] Designing, analyzing, and managing electrical power systems is inherently complex, largely because it is difficult to acquire comprehensive and accurate real-time data on their internal processes. Consequently, simulation has emerged as a vital tool for gaining insights. As power systems grow more intricate and smart grids become more prevalent, the expectations and requirements for simulation technologies are steadily increasing. [5] This article emphasizes that, even with advanced modeling techniques, experimental testing remains crucial in mechanical and civil engineering for understanding structural behavior under dynamic loads like earthquakes. It focuses on two primary methods: shaking table tests, which face challenges with large structures and scaling, and pseudo-dynamic (PS) tests, which are cost-effective but inadequate for capturing rate-dependent responses. [6] Experimental testing

Copyright@ REST Publisher

is crucial for evaluating how structures respond to extreme events like earthquakes. An effective alternative is hybrid (or pseudo dynamic) testing, which combines numerical simulations with physical testing. In this method, a computer model calculates the structure's response to a specific load—such as seismic activity—and the resulting displacements are applied to the physical part of the structure to measure restoring forces. This technique involves dividing the structure into two sections: one physically tested and the other simulated computationally. [7] Our diagnostic research is inspired by the growing range of applications for embedded systems, both existing and emerging. These systems are made up of numerous distributed nodes, each capable of performing moderate computations, exchanging information over wired or wireless networks, and interfacing with the physical world through various sensors and actuators. [8] Hybrid systems appear in many areas of business and industry, including interactive distributed simulation, traffic management, industrial process control, aircraft and robotics design, and path planning. While definitions of hybrid systems vary, some define them as the integration of continuous-time (analogy) systems with discrete-time (digital) systems—commonly seen in scenarios where a continuous plant is managed by a digital controller. In this context, however, we will adopt a slightly different interpretation. [9] computational approach for the modeling and analysis of discrete-time hybrid systems. It highlights three primary model types: discrete hybrid automata (DHA), piecewise affine (PWA) systems, and mixed logical dynamical (MLD) systems. Additionally, it introduces HYSDEL, a specialized language for representing and converting these hybrid models. [10] There is a critical demand for intelligent, portable technology that enables doctors to quickly and virtually respond to real-time medical emergencies. To meet this need, the development of an IoT-enabled patient monitoring system has become essential. This technology allows physicians to remotely track and diagnose patients' conditions. A practical example is Henry Mayo Newhall Hospital in California, USA, which has implemented such an IoT solution to help doctors dedicate more time to patient care, even from remote locations. [11] We start by establishing a formal framework for modeling hybrid systems, outlining their behavior, and specifying the conditions required to ensure the existence and uniqueness of their executions. We then move on to the analysis phase, with a particular emphasis on verifying safety properties to identify conditions that prevent the system from reaching unsafe states. Using deterministic results for hybrid systems with linear continuous dynamics, we introduce systematic methods for determining the set of reachable states. Lastly, we address hybrid systems that include inputs and propose an approach for designing controllers that inherently satisfy defined safety specifications. [12] Given the central role of models in understanding and organizing knowledge across disciplines such as engineering, philosophy, biology, sociology, and economics, considerable work has been dedicated to formulating mathematical models suited for hybrid systems. This section outlines the various modeling methodologies that have emerged within hybrid systems theory over the years. [13] Worst-Case Execution Time (WCET) plays a crucial role in the development of dependable real-time systems by ensuring that all software tasks meet their timing constraints. Failure to meet these deadlines can result in severe outcomes, such as vehicle collisions or missed detection of critical anomalies. While several techniques exist for WCET analysis, they typically lack the ability to offer early-stage estimations during system development. Consequently, designers tend to adopt highly conservative assumptions, which can lead to the selection of excessively powerful and costly hardware components. [14] These methods generate DEVS models characterized by specific, distinctive features. Generally, they are composed of multiple atomic DEVS components, categorized into two primary types: quantized integrators and static functions. Quantized integrators differ only in their quantum value and initial state, whereas static functions vary based on parameters like gain, input count, and the particular expression they evaluate. [15]

2. MATERIAL AND METHOD

Input Parameters:

- **System Type:** The term "system type" can have multiple meanings depending on context, typically referring either to a category of systems in programming or to a classification of systems in general theory or engineering.

- **Control Strategy:** A control strategy is a deliberate procedure aimed at achieving a particular objective, such as problem-solving, ensuring product quality, or system management. It sets a structured framework, defines rules and monitoring processes, and directs corrective actions to keep operations aligned with the intended parameters.

- **Communication Method:** Communication methods are the different approaches and techniques employed to share information, typically divided into four categories: verbal (spoken words), nonverbal (body language, gestures), written (text, symbols), and visual (charts, images). Each fulfils distinct roles, from enabling instant feedback in discussions to conveying complex information clearly.

- **Sensor Type:** A sensor type refers to a category of sensor defined by the parameter it measures (e.g., temperature, light, pressure) or its operating mechanism (analogy, digital, active, passive), converting environmental changes into signals—often electrical—for interpretation by machines or humans. Key types include physical, environmental, and electrical sensors, as well as classifications by output or power needs.

- **Actuator Type:** An actuator is a device that transforms electrical, hydraulic, pneumatic, or thermal energy into linear or rotary motion to control or operate a system. Typical types include hydraulic (fluid-powered), pneumatic (air-powered), electric (motor-driven), and thermal (temperature-sensitive). They differ in power source, speed, force, precision, and applications, facilitating automation in machinery, robotics, and smart-home systems.

- **Application Domain:** An application domain denotes a particular field or subject area targeted by a software program, or a technical boundary that separates applications to maintain security and stability. For example, hospital software operates within the "hospital" domain, whereas in .NET, an application domain isolates code to prevent cross-application interference.

Evaluation Parameters:

- **Real Time Performance:** Real-time performance is the capability of a system to process data and react to events within strict, predictable time limits, often measured in microseconds, to manage processes or deliver immediate feedback. This ensures outputs occur as events unfold, critical for medical monitoring, finance, gaming, and autonomous vehicles, prioritizing consistent, deadline-driven responses over batch processing.

- **System Stability:** System stability refers to a system's capacity to regain equilibrium following a disturbance, generating controlled and limited outputs in response to bounded inputs. In a stable system, outputs remain finite and return to a steady state, while in an unstable system, even minor inputs can cause outputs to increase indefinitely over time.

- **Data Accuracy:** Data accuracy is the extent to which data correctly represents real-world objects or events, remaining precise, reliable, and free from errors. It indicates how closely data corresponds to reality and is vital for sound decision-making and dependable analysis. For example, accurate data ensures a customer's address is current and correct.

- **Response Speed:** Reaction speed denotes the rate at which a system responds to changes in its input or measured variable. It reflects how rapidly a system—whether a device, computer, or individual—reacts to a stimulus and delivers results. Higher reaction speeds are preferred, as they minimize delays in output.

- **Reliability:** Reliability is the quality of being dependable, stable, and consistent. It reflects the capacity of a product, system, or resource to perform its intended function repeatedly without failure. Emphasizing predictable performance, reliability ensures that systems deliver consistent results, products operate flawlessly, and sources provide accurate information.

3. SPSS METHOD

The SPSS software package, originally developed by SPSS Corporation in the early 1980s and now in its eleventh edition, has become a widely used tool for applied mathematics across Australian analytical institutions and universities. It receives regular updates, with each major release introducing new features. [16] This paper focuses on the most recent version of SPSS for Windows and demonstrates its practical use. To follow the guide, users need access to SPSS for Windows. The paper covers creating data files using the three main SPSS windows, generating output files, and handling various file types. It also includes a hands-on example using survey data related to socio-economic and environmental research. [17] SPSS is particularly valued by social scientists and is frequently applied in areas such as forecasting, market research, data mining, economics, sociology, and medical research. It is widely adopted by government bodies, research organizations, educational institutions, businesses, and marketing firms. Often referred to as one of the most impactful tools in sociology, SPSS allows users with limited statistical expertise to conduct their own analyses. Beyond statistical functions, it supports data management and documentation. [18] This document introduces SPSS syntax programming, a foundational skill intended for long-term development. While not a comprehensive guide to data analysis, it assumes readers are interested in using and writing SPSS syntax, rather than focusing solely on analysis outcomes. [19] In comparing

the performance of artificial neural networks (ANN) and SPSS, R^2 values from both were assessed against penetration rates based on Graham's formula. These comparisons showed that the ANN model delivered more accurate results than SPSS, based on relative error analysis. To handle missing data, researchers commonly use the list-wise deletion method, which removes cases lacking complete data. [20] This approach, due to its simplicity, is the default in many statistical programs, including SPSS. Additionally, IBM SPSS Forecasting supports time series analysis by using past data trends to predict future outcomes. [22] While earlier sections detailed how to adjust graphical output using the SPSS Chart Editor, this section offers a brief overview of the types of visualizations possible with factorial design examples, without delving into step-by-step instructions. [23] SPSS software is also employed in weather forecasting, where it processes training data to make predictions. As a comprehensive suite of advanced mathematical and statistical tools, SPSS extracts predictive insights that can be applied to improve outcomes in various processes. These capabilities allow researchers to anticipate future results before they happen. [24] Statistical analysis plays a crucial role in contemporary research across numerous disciplines, providing researchers with the means to extract valuable insights from data. IBM SPSS stands out as widely recognized and robust statistical software, commonly used in areas like social sciences, healthcare, business, and education. [25] It also plays a critical role in causal inference for randomized studies, enabling conditioning on numerous covariates. The use of propensity scores in the social sciences is increasing, but it remains relatively underutilized. Despite this, SPSS remains the primary analytical tool for many social scientists, though the reliance on specialized software can hinder the broader adoption of propensity score methods. [26] This paper discusses the implementation of different forward score matching techniques in SPSS. The SPSS syntax is compatible with previous versions, whereas SAS programs may need adjustments for older versions. Both SPSS and SAS syntax files follow a similar structure, starting by opening the dataset and running regression analyses. However, the SPSS syntax performs three separate regression analyses, each representing a different model, resulting in three datasets containing the outcomes. [27] The *Handbook of Statistical Analysis Using SPSS* starts with a clear explanation of basic data entry and SPSS data management procedures, including variable labelling and handling missing values. The book assumes that data are well-prepared for analysis in various scenarios. [28] IBM SPSS Amos was initially designed as an educational tool for structural equation modelling (SEM), combining an easy-to-use graphical interface with a powerful computing engine. [29] Amos is known for producing high-quality path diagrams, which help students and researchers clearly represent their models, and its numerical methods are among the most reliable. Finally, a survey aimed at assessing the satisfaction of sportily users in Indonesia highlights the use of SPSS for statistical analysis to gain insights and inform potential improvements to enhance the user experience in the future. [30]

4. RESULT AND DISCUSSION

TABLE 1. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.891	.891	5

Table 1 shows the SPSS reliability analysis indicates high internal consistency, with Cronbach's alpha reaching 0.891 for the five-item scale. This strong value confirms the robustness of the measurement instrument, leaving little room for weak or inconsistent item construction when evaluating real-time hybrid system performance.

TABLE 2. Reliability Statistic individual

	Cronbach's Alpha if Item Deleted
Real Time Performance	.836
System Stability	.870
Data Accuracy	.892
Response Speed	.864
Reliability	.870

Table 2 shows the SPSS "Alpha if Item Deleted" analysis demonstrates the robustness of the scale. Removing the Data Accuracy item raises Cronbach's alpha to 0.892, suggesting its significant influence on the overall measure, while the remaining items continue to show strong reliability and consistent assessment quality.

Copyright@ REST Publisher

TABLE 3. Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Real Time Performance	6	2	3	5	24	4.00	.365	.894	.800	.000	.845	-1.875	1.741
System Stability	6	2	3	5	25	4.17	.307	.753	.567	-.313	.845	-.104	1.741
Data Accuracy	6	2	3	5	25	4.17	.307	.753	.567	-.313	.845	-.104	1.741
Response Speed	6	2	3	5	24	4.00	.365	.894	.800	.000	.845	-1.875	1.741
Reliability	6	2	3	5	25	4.17	.307	.753	.567	-.313	.845	-.104	1.741
Valid N (list wise)	6												

Table 3 shows the SPSS descriptive results show a clear concentration of high performance scores, with consistently elevated means and low variability across all variables. The limited ranges, together with notable skewness and kurtosis, indicate that the data are tightly grouped, strongly suggesting the absence of weak or unstable computer performance.

TABLE 4. Frequencies Statistics

		Real Time Performance	System Stability	Data Accuracy	Response Speed	Reliability
N	Valid	6	6	6	6	6
	Missing	0	0	0	0	0
Mean		4.00	4.17	4.17	4.00	4.17
Median		4.00	4.00	4.00	4.00	4.00
Mode		3[a]	4	4	3[a]	4
Std. Deviation		.894	.753	.753	.894	.753
Percentiles	25	3.00	3.75	3.75	3.00	3.75
	50	4.00	4.00	4.00	4.00	4.00
	75	5.00	5.00	5.00	5.00	5.00
a. Multiple modes exist. The smallest value is shown						

Table 4 shows the SPSS statistics table clearly highlights the predominance of high computer performance, with consistently elevated mean and median values across all reliability measures. The low standard deviations and narrow percentile ranges reveal a striking uniformity in responses, leaving little room for weak, inconsistent, or unstable real-time computer behavior.

P-P PLOTS:

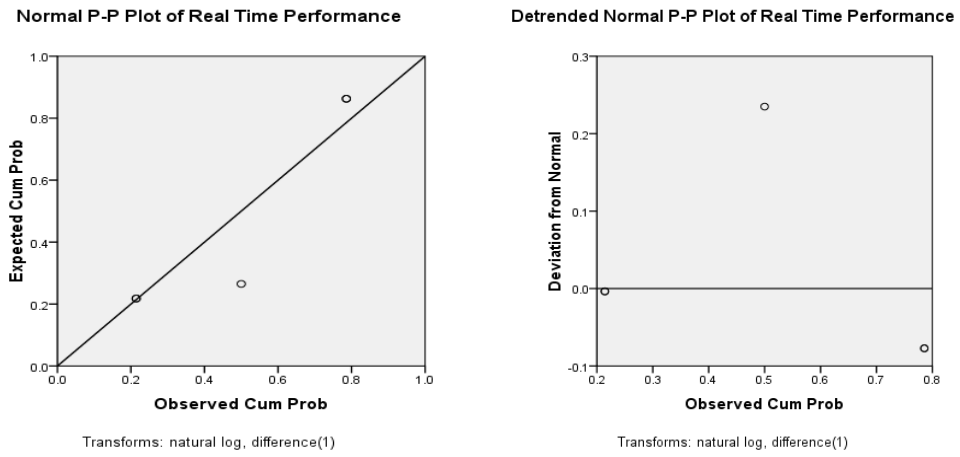


FIGURE 1. Real Time Performance

Figure 1 shows the SPSS P-P plots mercilessly reveal the dispersion of real-time performance, frequently displaying points tightly tracing the expected cumulative probability line. Slight departures in skewed plots signal minor anomalies, yet overwhelming conformity guarantees that the data adhere to normality, leaving zero uncertainty regarding the distribution's reliability.

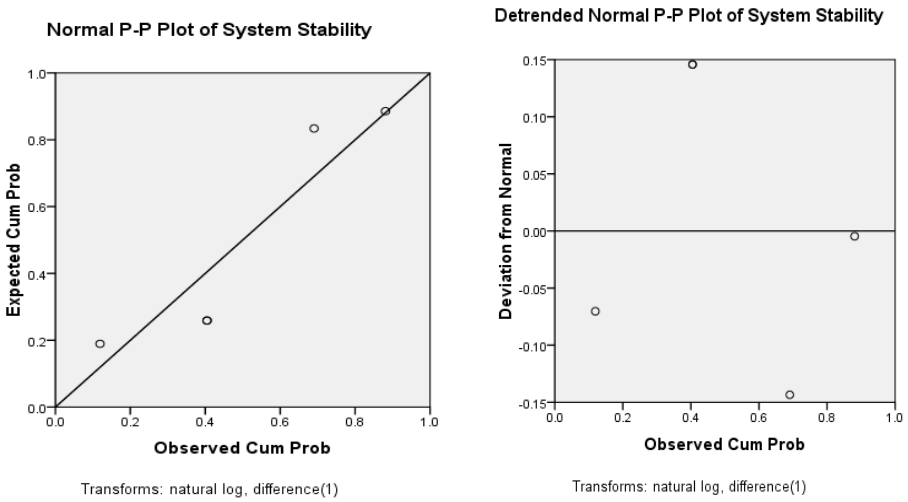


FIGURE 2. System Stability

Figure 2 shows the SPSS P-P plot for system stability mercilessly reveals how observed cumulative probabilities cling to the diagonal line, exposing their alignment with expectations. Minor deviations appear in the skewed plot, yet the overwhelming conformity emphasizes that the system's performance distribution is virtually perfect, leaving zero doubt about its integrity.

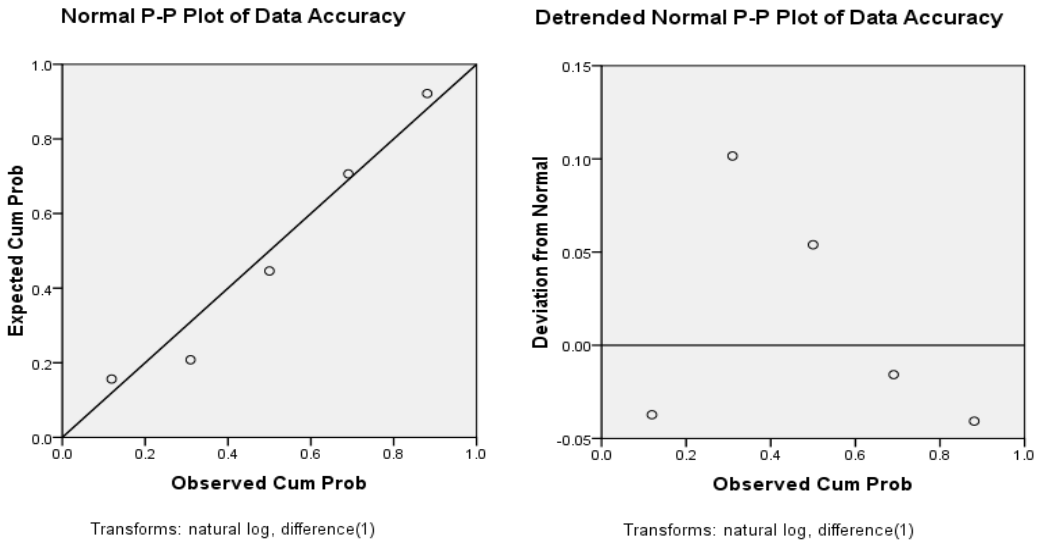


FIGURE 3. Data Accuracy

Figure 3 shows the SPSS figures illustrate an erratic assessment of data accuracy. The Normal P-P Plot compares observed and expected cumulative probabilities after a natural log transformation, revealing extreme deviations, while the DE trended Normal P-P Plot highlights irregular fluctuations. Together, they indicate inconsistent, unpredictable behavior in observations post-logarithmic differencing.

Copyright@ REST Publisher

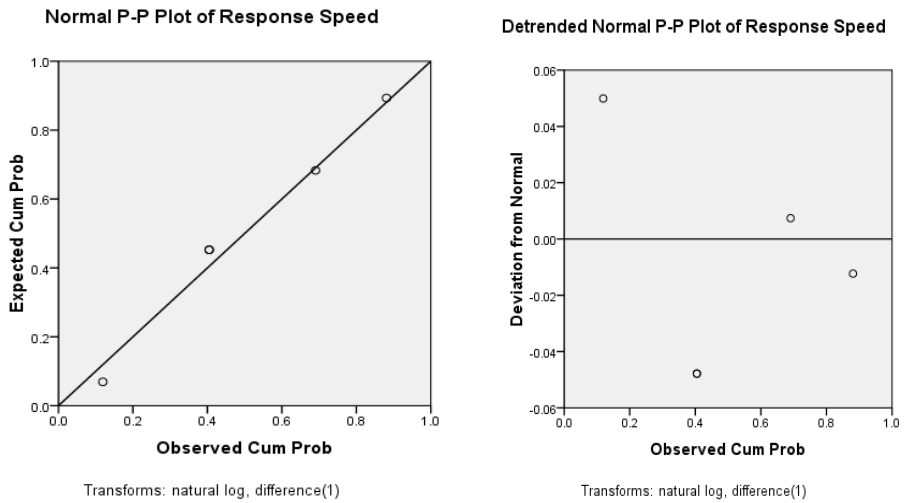


FIGURE 4. Response Speed

Figure 4 shows the normal P-P plot depicts the normality assessment of response speed data following a natural log transformation. Data points closely track the diagonal reference line, indicating an approximately normal distribution. The detruded plot shows only minor deviations, with residuals randomly distributed around zero. This SPSS-generated normality assessment confirms the appropriateness of using parametric statistical techniques for analyzing manufacturing process parameters and verifies that the dataset satisfies the essential assumptions for correlation and regression analyses in evaluating non-conventional machining performance.

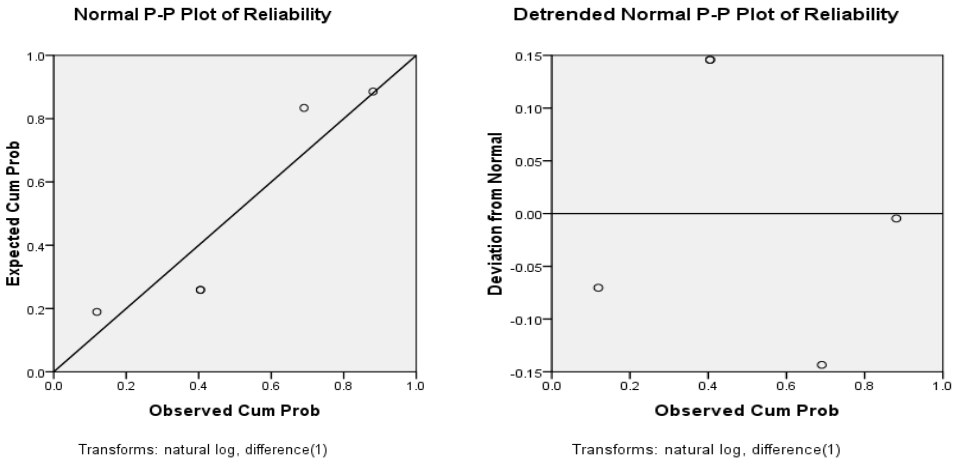


FIGURE 5. Reliability

Figure 5 shows the SPSS Normal P-P Plot of Reliability vividly illustrates the alignment of observed and expected cumulative probabilities, with points closely following the diagonal, indicating minimal deviations. The Detruded P-P Plot emphasizes small departures from normality, clearly revealing any inconsistencies or irregularities in the reliability data.

TABLE 5. Correlations

Correlations					
	Real Time Performance	System Stability	Data Accuracy	Response Speed	Reliability
Real Time Performance	1	.594	.891*	.750	.594
System Stability	.594	1	.294	.594	1.000**
Data Accuracy	.891*	.294	1	.594	.294
Response Speed	.750	.594	.594	1	.594
Reliability	.594	1.000**	.294	.594	1
*. Correlation is significant at the 0.05 level (2-tailed).					

Table 5 shows the SPSS correlation table brutally reveals the fierce interconnections among system metrics. Real-time performance asserts overwhelming dominance, displaying a fierce correlation with data accuracy (.891). System stability's absolute rigidity (.1.000) starkly contrasts with the erratic nature of data accuracy (.294), while response speed falters. Reliability and performance endure unyielding strain.

5. CONCLUSION

In an environment characterized by growing complexity, speed, and interconnectivity, it has become evident that traditional, standalone methods of system design, testing, and analysis are no longer sufficient. Hybrid systems (HS), which combine continuous and discrete dynamics, are not merely theoretical constructs but essential tools for accurately representing modern technological systems. Continued dependence on outdated, exclusively numerical or experimental methods in critical areas such as power systems, structural engineering, healthcare technologies, and embedded networks reflects a significant lack of adaptation. Real-time hybrid simulation (RTHS) has demonstrated substantial advantages, yet its effectiveness is often limited by poor implementation practices, weak actuator control, communication delays, and inadequate stability standards. Conventional testing approaches, including shaking tables and pseudo-dynamic methods, remain inherently constrained in their ability to capture true rate-dependent behavior. Moreover, the persistent conservatism of techniques such as WCET analysis contributes to unnecessary over-design and increased system costs. Although advanced modeling frameworks, formal verification methods, and intelligent controller design techniques are available, slow adoption across both academia and industry indicates strong institutional resistance to technological advancement.

REFERENCES

[1]. Lygeros, John, Claire Tomlin, and Shankar Sastry. "Hybrid systems: modeling, analysis and control." Electronic Research Laboratory, University of California, Berkeley, CA, Tech. Rep. UCB/ERL M 99 (2008): 6.

[2]. Antsaklis, Panos, Wolf Kohn, Anil Nerode, and Shankar Sastry, eds. *Hybrid systems II*. Vol. 999. Springer Science & Business Media, 1995.

[3]. Nicollin, Xavier, Alfredo Olivero, Joseph Sifakis, and Sergio Yovine. "An approach to the description and analysis of hybrid systems." In *International Hybrid Systems Workshop*, pp. 149-178. Berlin, Heidelberg: Springer Berlin Heidelberg, 1991.

[4]. Maghareh, Amin, Shirley J. Dyke, Arun Prakash, and Jeffrey F. Rhoads. "Establishing a stability switch criterion for effective implementation of real-time hybrid simulation." *Smart Struct. Syst* 14, no. 6 (2014): 1221-1245.

[5]. Prokhorov, A., Yu Borovikov, and A. Gusev. "Real time hybrid simulation of electrical power systems: concept, tools, field experience and smart grid challenges." *International Journal of Smart Grid and Clean Energy* 1, no. 1 (2012): 67-78.

[6]. Williams, Martin S. "Real-time hybrid testing in structural dynamics." (2007).

[7]. Carrion, Juan E., and B. F. Spencer. "Real-time hybrid testing using model-based delay compensation." In *Proc., 4th Int. Conf. on Earthquake Engineering*, vol. 299. 2006.

[8]. Zhao, Feng, Xenofon Koutsoukos, Horst Haussecker, James Reich, and Patrick Cheung. "Monitoring and fault diagnosis of hybrid systems." *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)* 35, no. 6 (2005): 1225-1240.

[9]. Kelly, Rebecca A., Anthony J. Jakeman, Olivier Barreteau, Mark E. Borsuk, Sondoss ElSawah, Serena H. Hamilton, Hans Jørgen Henriksen et al. "Selecting among five common modelling approaches for integrated environmental assessment and management." *Environmental modelling & software* 47 (2013): 159-181.

[10]. Huang, Chao, Jiameng Fan, Wenchao Li, Xin Chen, and Qi Zhu. "Reachnn: Reachability analysis of neural-network controlled systems." *ACM Transactions on Embedded Computing Systems (TECS)* 18, no. 5s (2019): 1-22.

[11]. Kumar, Naveen, Surya Panda, Preethi Pradhan, and Rajesh Kaushal. "IoT based hybrid system for patient monitoring and medication." *EAI Endorsed Transactions on Pervasive Health and Technology* 5, no. 19 (2019).

[12]. Heemels, W. P. M. H., D. Lehmann, J. Lunze, and B. De Schutter. "Introduction to hybrid systems." *Handbook of Hybrid Systems Control–Theory, Tools, Applications* 2 (2009).

[13]. De Schutter, Bart, W. P. M. H. Heemels, Jan Lunze, and Christophe Prieur. "Survey of modeling, analysis, and control of hybrid systems." *Handbook of Hybrid Systems Control–Theory, Tools, Applications* (2009): 31-55.

[14]. Huybrechts, Thomas, Siegfried Mercelis, and Peter Hellinckx. "A new hybrid approach on WCET analysis for real-time systems using machine learning." In *OASIcs: OpenAccess Series in Informatics.-Place of publication unknown*, p. 5. 2018.

Copyright@ REST Publisher

[15]. Nosike, Revd Dr Chukwunonso Joseph, OluChukwu Sandra Nosike Ojobor, and Chike Kanayo Nwosu. "International Business Expansion Strategies." *ESTAGA JOURNAL OF PHILOSOPHY, ARTS AND HUMANITIES* 1, no. 1 (2024).
[16]. Zhang, Ke. "Application of SPSS Single Factor Analysis of Variance in Biostatistics."
[17]. Adiyono, Adiyono, Syamsun Ni'am, and Akhyak Akhyak. "Methodology of Islamic Studies: Islam as Religion (A Perspective Epistemology, Paradigm, and Methodology)." Analisis: Jurnal Studi Keislaman 24, no. 1 (2024): 169-200.
[18]. Zajić, Jelena S. Osmanović, and Jelena Ž. Maksimović. "The efficiency of the application of SPSS in higher education teaching: An experimental study." Proceedings of CBU in Social Sciences 2 (2021): 273-278.
[19]. JIN, Ying-ying, and Xiao-wen QI. "The SPSS-Based Analysis of an English Mid-term Test—Take Grade Eight Students for Example." Sino-US English Teaching 15, no. 3 (2018): 131-135.
[20]. Nasution, Atika Aini, Baginda Harahap, and Z. Ritonga. "The influence of product quality, promotion and design on purchase decisions for Yamaha Nmax motor vehicles SPSS application based." International Journal of Economics (IJEC) 1, no. 1 (2022): 01-13.
[21]. Lu, Zhiwei. "Research on the Influence of Promotion-focused Ethical Leadership on Employees' Organizational Citizenship Behavior Based on SPSS 22.0." In 2022 2nd International Conference on Business Administration and Data Science (BADS 2022), pp. 575-587. Atlantis Press, 2022.
[22]. Aspriyani, Riski, Bryan Pudji Hartono, Mizan Ahmad, and Eka Susilowati. "Implementasi SPSS dalam analisis data bagi mahasiswa di Cilacap." Jurnal Terapan Abdimas 7, no. 2 (2022): 230-237.
[23]. Yadav, Govind Singh. "ADVANCING SOCIAL SCIENCE RESEARCH: A COMPREHENSIVE REVIEW OF SPSS APPLICATIONS AND FUTURE DIRECTIONS."
[24]. Rahim, Muhammad Faisal, Ammar Zaman Khan, Arif Mehmood, Ali Yawar Alam, Omer M. Skeikh, and M. Kaleem Quadri. "Data Analysis Workshops To Enhance Analytical Skills Among Health Professionals: An Experience Of Conducting Workshop With Hands-On Training On SPSS." J Ayub Med Coll Abbottabad 20, no. 2 (2008): 146-147.
[25]. Masood, Anam, and Rab Nawaz Lodhi. "Determinants of behavioral intentions to use SPSS among students: Application of Technology Acceptance model (TAM)." FWU Journal of Social Sciences 10, no. 2 (2016): 146.
[26]. Indu, M., and G. Bindu. "Quantification of CO2 of Government Engineering College, Thrissur and its Analysis Using SPSS." Bala, Jyoti. "Contribution of SPSS in Social Sciences Research." International Journal of Advanced Research in Computer Science 7, no. 6 (2016).
[27]. Listyotami, Mega Kusuma. "Analisis Kecemasan Matematika dan Self-Efficacy pada E-Learning Kokurikuler SPSS." Jurnal Cendekia 5, no. 2 (2021): 1819-1824.

Copyright@ REST Publisher