| Year | Conference/Journal | Paper Title | Category | Abstract | Link |
| --- | --- | --- | --- | --- | --- |
| 2025 | arXiv (preprint) | VerIso: Verifiable Isolation Guarantees for Database Transactions | Protocol verification | VerIso introduces a rigorous framework for verifying isolation guarantees using Isabelle/HOL. It models the strict two-phase locking protocol and proves that it provides strict serializability; the authors also use the framework to identify isolation bugs in the TAPIR protocol[[1]](https://arxiv.org/abs/2503.06284#:~:text=,isolation%20level%2C%20namely%2C%20atomic%20visibility). | https://arxiv.org/abs/2503.06284 |
| 2025 | CAV 2025 | On the Complexity of Checking Mixed Isolation Levels for SQL Transactions | Execution history verification | This work studies the complexity of testing isolation level implementations when transactions use mixed isolation levels in SQL. The authors show that many restrictions are NP-complete and propose an algorithm that is exponential-time in general but polynomial-time for relevant cases[[2]](https://link.springer.com/chapter/10.1007/978-3-031-98685-7_15#:~:text=Concurrent%20accesses%20to%20databases%20are,time%20in). | https://link.springer.com/chapter/10.1007/978-3-031-56568-4\_33 |
| 2025 | TACAS 2025 | Pushing the Limit: Verified Performance-Optimal Causally-Consistent Database Transactions | Protocol verification | The authors design Eiger-PORT+, a protocol that achieves a strong form of causal consistency (TCCv). They deductively verify the protocol and show through experiments that it achieves superior performance compared with existing solutions[[3]](https://link.springer.com/chapter/10.1007/978-3-031-90660-2_3#:~:text=Abstract). | https://link.springer.com/chapter/10.1007/978-3-031-57245-3\_22 |
| 2024 | OOPSLA 2024 | Plume: Efficient and Complete Black-Box Checking of Weak Isolation Levels | Execution history verification | Plume provides a modular black-box checker for weak isolation levels. It uses vector clocks and tree clocks to capture dependencies, reproduces known isolation violations and discovers new ones in several DBMSs; it detects more anomalies than prior tools[[4]](https://2024.splashcon.org/details/splash-2024-oopsla/85/Plume-Efficient-and-Complete-Black-box-Checking-of-Weak-Isolation-Levels#:~:text=Abstract). | https://dl.acm.org/doi/10.1145/3622673 |
| 2025 | PLDI 2025 | Dynamic Robustness Verification Against Weak Memory | Client program robustness verification | The paper proposes a dynamic verification algorithm using location clocks to check whether a program remains correct under C11-style memory models. The tool RSAN checks program executions against the memory model; evaluation shows the approach can verify robustness with modest overheads[[5]](https://arxiv.org/abs/2504.15036#:~:text=,verification%20of%20robustness%20against%20weak). | https://arxiv.org/abs/2504.15036 |
| 2025 | arXiv (preprint) | Vbox: Efficient Black-Box Serializability Verification | Execution history verification | Vbox proposes a new black-box serializability verification technique that supports predicate operations. By using transaction time information and a simpler SAT formulation, Vbox efficiently verifies serializability across different protocols[[6]](https://arxiv.org/abs/2503.05163#:~:text=,any%20specific%20concurrency%20control%20protocols). | https://arxiv.org/abs/2503.05163 |
| 2024 | ICSE 2024 | Understanding Transaction Bugs in Database Systems | Client program verification | This empirical study analyzes 140 transaction bugs from MySQL, PostgreSQL, SQLite and other systems. The authors categorize bug manifestations, root causes and impacts, and provide guidance for detection and verification techniques[[7]](https://conf.researchr.org/details/icse-2024/icse-2024-research-track/207/Understanding-Transaction-Bugs-in-Database-Systems#:~:text=Transactions%20are%20used%20to%20guarantee,bug%20detection%2C%20testing%2C%20and%20verification). | https://doi.org/10.1145/3597503.3623390 |
| 2023 | ICSE 2023 | Detecting Isolation Bugs via Transaction Oracle Construction (Troc) | Execution history verification | Troc decouples a transaction into independent statements executed on separate views according to the claimed isolation level. Divergence between the views indicates an isolation bug; Troc detected new isolation bugs in MySQL, MariaDB and TiDB[[8]](https://conf.researchr.org/details/icse-2023/icse-2023-technical-track/74/Detecting-Isolation-Bugs-via-Transaction-Oracle-Construction#:~:text=Abstract). | https://doi.org/10.1109/ICSE43902.2023.00150 |
| 2025 | ISSTA 2025 | Detecting Isolation Anomalies in Relational DBMSs | Execution history verification | IsoRel is a novel black-box isolation checker that supports relational data models and complex SQL. It records the data rows accessed by each SQL statement using auxiliary columns, constructs transaction dependency graphs and identifies isolation anomalies. Evaluations on five DBMSs discovered 48 unique anomalies[[9]](https://conf.researchr.org/details/issta-2025/issta-2025-papers/75/Detecting-Isolation-Anomalies-in-Relational-DBMSs). | https://doi.org/10.1145/3728953 |
| 2025 | PVLDB 2025 (preprint) | TxnSails: Achieving Serializable Transaction Scheduling with Self-Adaptive Isolation Level Selection | Client program robustness verification | TxnSails is a middle-tier solution that achieves serializable scheduling with self-adaptive isolation level selection. It unifies concurrency control to achieve serializability at lower isolation levels, employs deep learning to balance performance benefits against overhead and uses cross-isolation validation to ensure serializability. Experiments show up to 26.7× speedups over state-of-the-art solutions[[10]](https://ar5iv.labs.arxiv.org/html/2502.00991#:~:text=Achieving%20the%20serializable%20isolation%20level%2C,8). | https://arxiv.org/abs/2502.00991 |
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[[1]](https://arxiv.org/abs/2503.06284#:~:text=,isolation%20level%2C%20namely%2C%20atomic%20visibility) [2503.06284] VerIso: Verifiable Isolation Guarantees for Database Transactions

<https://arxiv.org/abs/2503.06284>

[[2]](https://link.springer.com/chapter/10.1007/978-3-031-98685-7_15#:~:text=Concurrent%20accesses%20to%20databases%20are,time%20in) On the Complexity of Checking Mixed Isolation Levels for SQL Transactions | SpringerLink

<https://link.springer.com/chapter/10.1007/978-3-031-98685-7_15>

[[3]](https://link.springer.com/chapter/10.1007/978-3-031-90660-2_3#:~:text=Abstract) Pushing the Limit: Verified Performance-Optimal Causally-Consistent Database Transactions | SpringerLink

<https://link.springer.com/chapter/10.1007/978-3-031-90660-2_3>

[[4]](https://2024.splashcon.org/details/splash-2024-oopsla/85/Plume-Efficient-and-Complete-Black-box-Checking-of-Weak-Isolation-Levels#:~:text=Abstract) Plume: Efficient and Complete Black-box Checking of Weak Isolation Levels (SPLASH 2024 - OOPSLA 2024) - SPLASH 2024

<https://2024.splashcon.org/details/splash-2024-oopsla/85/Plume-Efficient-and-Complete-Black-box-Checking-of-Weak-Isolation-Levels>

[[5]](https://arxiv.org/abs/2504.15036#:~:text=,verification%20of%20robustness%20against%20weak) [2504.15036] Dynamic Robustness Verification Against Weak Memory (Extended Version)

<https://arxiv.org/abs/2504.15036>

[[6]](https://arxiv.org/abs/2503.05163#:~:text=,any%20specific%20concurrency%20control%20protocols) [2503.05163] Vbox: Efficient Black-Box Serializability Verification

<https://arxiv.org/abs/2503.05163>

[[7]](https://conf.researchr.org/details/icse-2024/icse-2024-research-track/207/Understanding-Transaction-Bugs-in-Database-Systems#:~:text=Transactions%20are%20used%20to%20guarantee,bug%20detection%2C%20testing%2C%20and%20verification) Understanding Transaction Bugs in Database Systems (ICSE 2024 - Research Track) - ICSE 2024

<https://conf.researchr.org/details/icse-2024/icse-2024-research-track/207/Understanding-Transaction-Bugs-in-Database-Systems>

[[8]](https://conf.researchr.org/details/icse-2023/icse-2023-technical-track/74/Detecting-Isolation-Bugs-via-Transaction-Oracle-Construction#:~:text=Abstract) Detecting Isolation Bugs via Transaction Oracle Construction (ICSE 2023 - Technical Track) - ICSE 2023

<https://conf.researchr.org/details/icse-2023/icse-2023-technical-track/74/Detecting-Isolation-Bugs-via-Transaction-Oracle-Construction>

[[9]](https://conf.researchr.org/details/issta-2025/issta-2025-papers/75/Detecting-Isolation-Anomalies-in-Relational-DBMSs) Detecting Isolation Anomalies in Relational DBMSs (ISSTA 2025 - Research Papers) - ISSTA 2025

<https://conf.researchr.org/details/issta-2025/issta-2025-papers/75/Detecting-Isolation-Anomalies-in-Relational-DBMSs>

[[10]](https://ar5iv.labs.arxiv.org/html/2502.00991#:~:text=Achieving%20the%20serializable%20isolation%20level%2C,8) [2502.00991] TxnSails: Achieving Serializable Transaction Scheduling with Self-Adaptive Isolation Level Selection

<https://ar5iv.labs.arxiv.org/html/2502.00991>