

« The Scientific Work of Reinhard Wilhelm »

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Laudatio für Reinhard Wilhelm — Saarbrücken —
June 11th, 2006

— 1 —

Just in case you don't know him



Just in case you don't know him,
or arrived late :-)



A talent for organization

— 3 —

Scientific Director of the International Conference and Research Center for Computer Science in Schloß Dagstuhl

- Unique and known by every researcher in computer science in the world
- This achievement only would be the best service for the progress of research in computer science



Scientific Director of the International Conference and Research Center for Computer Science in Schloß Dagstuhl

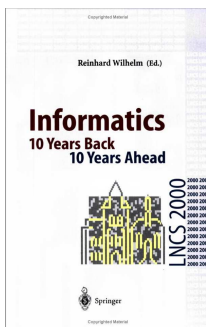
Where you learn most about Reinhard's tastes:

- A friendly place, with [highest scientific standards](#)
- Paintings, bicycles, music instruments, french wines, games, literature, good food, library, . . .



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Organizer of Landmark Scientific Events



References

- [1] R. Wilhelm. *Informatics : 10 Years Back. 10 Years Ahead*. Lecture Notes in Computer Science 2000. Springer, Berlin, Germany, 2001.
- [2] R. Wilhelm: *Compiler Construction*, 10th International Conference, CC 2001 Held as Part of the Joint European Conferences on Theory and Practice of Software, ETAPS 2001 Genova, Italy, April 2-6, 2001, Proceedings Springer 2001
- [3] R. Wilhelm: *Informatik: Grundlagen - Anwendungen - Perspektiven* [Forum "Perspektiven der Informatik", Dagstuhl, November 1993] Verlag C. H. Beck 1996
- [4] R. Wilhelm: *Generische und generative Methoden. Perspektiven der Informatik 1993: 84-85*
- [5] R. Wilhelm, H. Hagen: *Programmiersprachen. Perspektiven der Informatik 1993: 86-90*
- [6] V. Claus, R. Wilhelm: *Einleitung. Perspektiven der Informatik 1993: 9-12*
- [7] R. Wilhelm, O. Spaniol: *Parallele und verteilte Systeme. Perspektiven der Informatik 1993: 90-94*
- [8] Bernard Robinet, Reinhard Wilhelm: *ESOP 86, European Symposium on Programming, Saarbrücken, Federal Republic of Germany, March 17-19, 1986, Proceedings, LNCS 213, Springer 1986*
- [9] Reinhard Wilhelm: *GI - 10. Jahrestagung, Saarbrücken, 30. September - 2. Oktober 1980, Proceedings Springer 1980*



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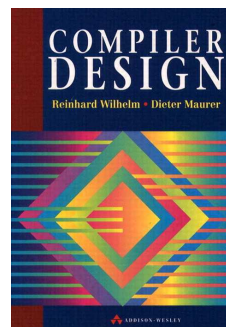
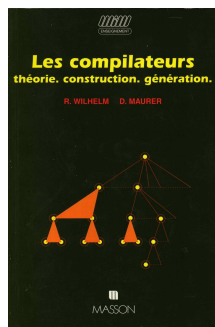
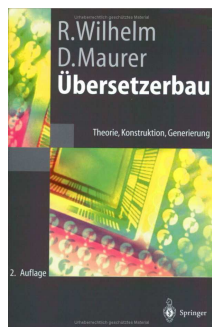
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A talent for pedagogy

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Chair for Programming Languages and Compiler Construction at Saarland University



References

- [10] R. Wilhelm and D. Maurer. *Übersetzerbau - Theorie, Konstruktion, Generierung*. Springer, Berlin, Germany, 1992, 2. Auflage Springer 1997
- [11] R. Wilhelm and D. Maurer. *Les Compilateurs, théorie, construction, génération*. Masson, Paris, France, 1994.
- [12] R. Wilhelm and D. Maurer. *Compiler Design: Theory, Construction, Generation*. Addison-Wesley Pub. Co., Reading, Massachusetts, United States, second printing edition, 1996.
- [13] P. Caspi, A. L. Sangiovanni-Vincentelli, Luís Almeida, A. Benveniste, B. Bouysssonouse, G. C. Buttazzo, I. Crnkovic, W. Damm, J. Engblom, G. Fohler, M. García-Valls, H. Kopetz, Y. Lakhnech, François Laroussinie, L. Lavagno, G. Lipari, F. Maraninchi, P. Peti, J. Antonio de la Puente, N. Scaife, J. Sifakis, R. de Simone, M. Törngren, P. Verissimo, A.J. Wellings, R. Wilhelm, T.A.C. Willemse, Wang Yi: Guidelines for a graduate curriculum on embedded software and systems. *ACM Trans. Embedded Comput. Syst.* 4(3): 587-611 (2005)



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A talent for research

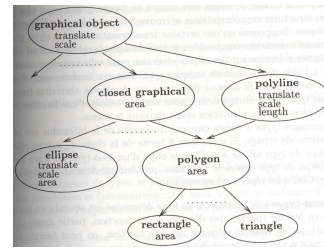
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Programming



Foundations of programming & languages

Interest and contributions in all styles of programming (imperative, functional, logic, parallel, object, text layout) [14, 15, 16, 17, 19, 21, 22, 24, 25, 26], including programming systems [18] and implementations [20, 22]



References

- [14] R. Wilhelm: Imperative, prädikative und funktionale Programmierung (Kurzfassung). GI Jahrestagung 1982: 188-193
- [15] J. Messerschmidt, R. Wilhelm: Constructors for Composed Objects. Comput. Lang. 7(2): 53-59 (1982)
- [16] R. Wilhelm: Symbolische Programmausführung - Das aktuelle Schlagwort. Informatik Spektrum 6(3): 170 (1983)
- [17] J. Loeckx, K. Mehlhorn, R. Wilhelm: Grundlagen der Programmiersprachen Teubner 1986
- [18] G. Becker, B. Kuhn, D. Maurer, R. Wilhelm: SiATEX - eine interaktive Arbeitsumgebung für TEX. Innovative Informations-Infrastrukturen 1988: 162-169
- [19] J. Loeckx, K. Mehlhorn, R. Wilhelm: Foundations of Programming Languages. John Wiley 1989
- [20] M. Baston, H.-J. Bach, A. Lucks-Baus, F. Müller, R. Wilhelm: Implementierung der funktionalen Programmiersprache HOPE mit Hilfe von Kombinatoren. Innovative Informations-Infrastrukturen 1988: 114-131
- [21] R. Wilhelm: Übersetzer für imperative, funktionale und logische Programmiersprachen: Ein Vergleich (eingeladener Vortrag). Software-Entwicklung 1989: 156-165
- [22] Y. Ben-Asher, G. Rünger, A. Schuster, R. Wilhelm: 2DT-FP: An FP Based Programming Language for Efficient Parallel Programming of Multiprocessor Networks. PARLE 1993: 42-55
- [23] Y. Ben-Asher, G. Rünger, R. Wilhelm, A. Schuster: Implementing 2DT on a Multiprocessor. CC 1994: 113-127
- [24] T. Rauber, G. Rünger, R. Wilhelm: An application specific parallel programming paradigm. HPCN Europe 1995: 735-740
- [25] R. Heckmann, R. Wilhelm: A Functional Description of TEX's Formula Layout. J. Funct. Program. 7(5): 451-485 (1997)
- [26] P. Lucas, N. Fritz, R. Wilhelm: The Development of the Data-Parallel GPU Programming Language CGIS. International Conference on Computational Science (4) 2006: 200-203

Algorithm Animation and Visualization



Visualization of computations

Illustrate graphically the run-time/abstract computations of programs [27, 28, 29, 30, 31]

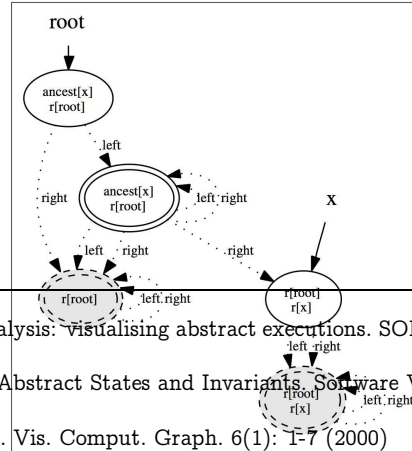


Figure 4. A visualisation graph

References

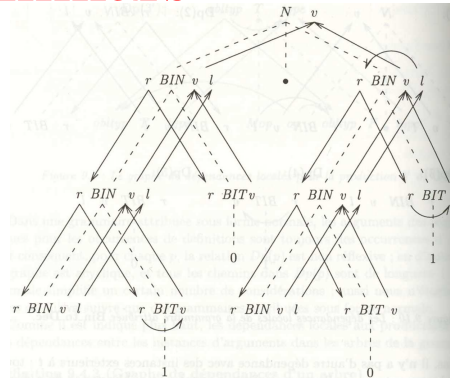
- [27] D. Johannes, R. Seidel, R. Wilhelm: Algorithm animation using shape analysis: visualising abstract executions. SOFTVIS 2005: 17-26
- [28] R. Wilhelm, T. Müldner, R. Seidel: Algorithm Explanation: Visualizing Abstract States and Invariants. Software Visualization 2001: 381-394
- [29] B. Braune, R. Wilhelm: Focusing in Algorithm Explanation. IEEE Trans. Vis. Comput. Graph. 6(1): 1-7 (2000)
- [30] B. Braune, S. Diehl, A. Kerren, R. Wilhelm: Animation of the Generation and Computation of Finite Automata for Learning Software. WIA 1999: 39-47
- [31] G. Sander, M. Alt, C. Ferdinand, R. Wilhelm: CLaX - A Visualized Compiler. Graph Drawing 1995: 459-462

Compiler Construction



Attribute grammars

Study, static analysis, implementation and applications of attribute grammars [32, 33, 34, 35, 36, 37, 39, 40, 41] and generalizations [38]



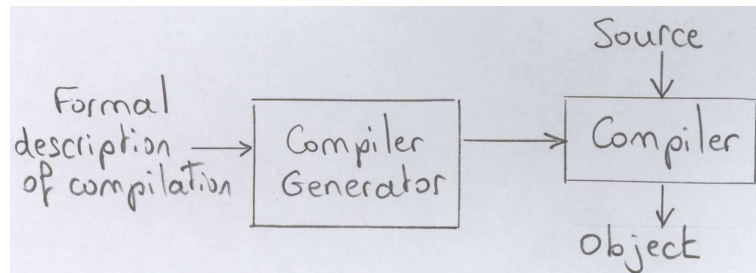
References

- [32] R. Giegerich, R. Wilhelm: Implementierbarkeit attributierter Grammatiken. GI Jahrestagung 1977: 17-36
- [33] R. Giegerich, R. Wilhelm: Counter-One-Pass Features in One-Pass Compilation: A Formalization Using Attribute Grammars. Inf. Process. Lett. 7(6): 279-284 (1978)
- [34] R. Wilhelm: Attributierte Grammatiken. Informatik Spektrum 2(3): 123-130 (1979)
- [35] R. Wilhelm: LL- and LR-Attributed Grammars. Fachtagung über Programmiersprachen 1982: 151-164
- [36] U. Möncke, B. Weisgerber, R. Wilhelm: How to Implement a System for Manipulation of Attributed Trees. Fachtagung über Programmiersprachen 1984: 112-127
- [37] P. Lipps, U. Möncke, M. Olk, R. Wilhelm: Attribute (Re)evaluation in OPTRAN. Acta Inf. 26(3): 213-239 (1988)
- [38] Winfried Thome, R. Wilhelm: Simulating Circular Attribute Grammars Through Attribute Reevaluation. Inf. Process. Lett. 33(2): 79-81 (1989)
- [39] R. Wilhelm: Attributive Reevaluation in OPTRAN. Attribute Grammars, Applications and Systems 1991: 507
- [40] P. Lipps, U. Möncke, R. Wilhelm: An Overview of the OPTRAN System. Attribute Grammars, Applications and Systems 1991: 505-506
- [41] U. Möncke, R. Wilhelm: Grammar Flow Analysis. Attribute Grammars, Applications and Systems 1991: 151-186

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Compilers and compiler generators

- Compilers [46, 47]
- Tools for generating compilers from specifications [42, 43, 44, 45]



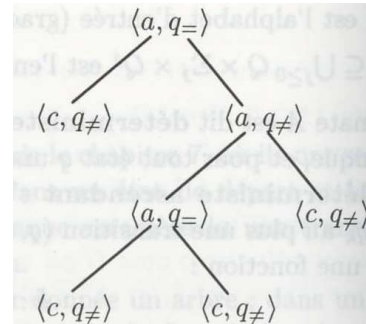
References

- [42] H. Ganzinger, R. Wilhelm: Verschränkung von Compiler-Moduln. GI Jahrestagung 1975: 654-665
- [43] R. Wilhelm, K. Ripken, J. Ciesinger, H. Ganzinger, Walter Lahner, R. Nollmann: Design Evaluation of the Compiler Generating System MUGI. ICSE 1976: 571-576
- [44] H. Ganzinger, K. Ripken, R. Wilhelm: Automatic Generation of Optimizing Multipass Compilers. IFIP Congress 1977: 535-540
- [45] H. Ganzinger, R. Giegerich, U. Möncke, R. Wilhelm: A Truly Generative Semantics-Directed Compiler Generator. SIGPLAN Symposium on Compiler Construction 1982: 172-184
- [46] R. Wilhelm, M. Alt, F. Martin, M. Raber: Parallel Implementation of Functional Languages. LOMAPS 1996: 279-295
- [47] P. Lucas, N. Fritz, R. Wilhelm: The CGiS Compiler-A Tool Demonstration. CC 2006: 105-108



Compilation algorithms

- Graph reduction [49]
- Code generation with transformational grammars/tree automata [48, 50, 52, 53, 54, 56]
- Code optimization [57]
- Virtual machines [51, 55]



References

- [48] R. Wilhelm: Code-Optimierung Mittels Attributierter Transformationsgrammatiken. GI Jahrestagung 1974: 257-266
- [49] M. Raber, T. Rempel, E. Hoffmann, D. Maurer, F. Müller, H.-G. Oberhauser, R. Wilhelm: Compiled Graph Reduction on a Processor Network. ARCS 1988: 198-212
- [50] B. Weisgerber, R. Wilhelm: Two Tree Pattern Matchers for Code Selection. CC 1988: 215-229
- [51] D. Maurer, R. Wilhelm: MaMa - eine abstrakte Maschine zur Implementierung funktionaler Programmiersprachen. Inform., Forsch. Entwickl. 4(2): 67-88 (1989)
- [52] C. Ferdinand, H. Seidl, R. Wilhelm: Tree Automata for Code Selection. Code Generation 1991: 30-50
- [53] R. Wilhelm: Tree Transformations, Functional Languages, and Attribute Grammars. WAGA 1990: 116-129
- [54] J. Börstler, U. Möncke, R. Wilhelm: Table Compression for Tree Automata. ACM Trans. Program. Lang. Syst. 13(3): 295-314 (1991)
- [55] M. Alt, G. Sander, R. Wilhelm: Generation of Synchronization Code for Parallel Compilers. PLILP 1993: 420-421
- [56] C. Ferdinand, H. Seidl, R. Wilhelm: Tree Automata for Code Selection. Acta Inf. 31(8): 741-760 (1994)
- [57] P. G. Bouillon, G. Sander, R. Wilhelm: Lokale Optimierung ausnahmebehafteter Programme durch Spuroptimierung. Inform., Forsch. Entwickl. 9(2): 72-81 (1994)

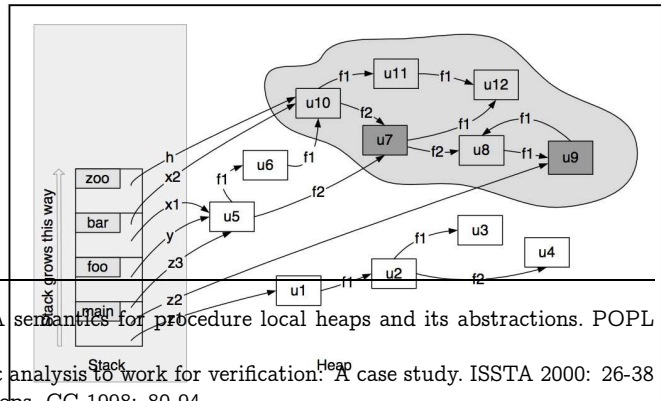
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Static Program Analysis and Transformation



Program flow analysis

Static determination of runtime properties of programs [58, 59, 60, 61, 62, 63, 64, 65]



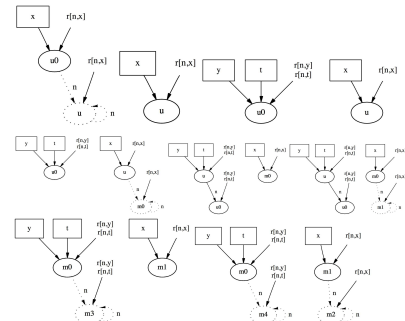
References

- [58] N. Rinetzky, J. Bauer, T. W. Reps, S. Sagiv, R. Wilhelm: A semantics for procedure local heaps and its abstractions. POPL 2005: 296-309
- [59] T. Lev-Ami, T. W. Reps, S. Sagiv, R. Wilhelm: Putting static analysis to work for verification. A case study. ISSTA 2000: 26-38
- [60] F. Martin, M. Alt, R. Wilhelm, C. Ferdinand: Analysis of Loops. CC 1998: 80-94
- [61] S. Sagiv, N. Francez, M. Rodeh, R. Wilhelm: A Logic-Based Approach to Program Flow Analysis. Acta Inf. 35(6): 457-504 (1998) 1997
- [62] R. Wilhelm: Program Analysis: A Toolmaker's Perspective. SIGPLAN Notices 32(1): 120-121 (1997) 1996
- [63] R. Wilhelm: Program Analysis - A Toolmaker's Perspective. ACM Comput. Surv. 28(4es): 177 (1996)
- [64] S. Sagiv, N. Francez, M. Rodeh, R. Wilhelm: A Logic-Based Approach to Data Flow Analysis Problem. PLILP 1990: 277-292
- [65] R. Wilhelm: Computation and Use of Data Flow Information in Optimizing Compilers. Acta Inf. 12: 209-225 (1979)

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Shape analysis

Static program analysis to determine the possible shapes of dynamically allocated data structures [66, 67, 68, 69, 70, 71, 72, 73, 74]



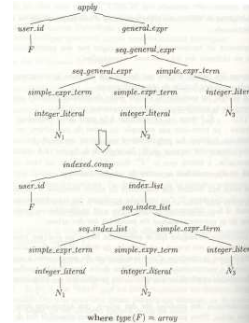
References

- [66] S. Sagiv, T. W. Reps, R. Wilhelm: Solving Shape-Analysis Problems in Languages with Destructive Updating. POPL 1996: 16-31
- [67] S. Sagiv, T. W. Reps, R. Wilhelm: Solving Shape-Analysis Problems in Languages with Destructive Updating. ACM Trans. Program. Lang. Syst. 20(1): 1-50 (1998)
- [68] S. Sagiv, T. W. Reps, R. Wilhelm: Parametric Shape Analysis via 3-Valued Logic. POPL 1999: 105-118
- [69] R. Wilhelm, S. Sagiv, T. W. Reps: Shape Analysis. CC 2000: 1-17
- [70] R. Wilhelm, T. W. Reps, S. Sagiv: Shape Analysis and Applications. The Compiler Design Handbook 2002: 175-218
- [71] S. Sagiv, T. W. Reps, R. Wilhelm: Parametric shape analysis via 3-valued logic. ACM Trans. Program. Lang. Syst. 24(3): 217-298 (2002)
- [72] G. Yorsh, T. W. Reps, S. Sagiv, R. Wilhelm: Logical Characterizations of Heap Abstractions CoRR cs.LO/0312014: (2003)
- [73] E. Yahav, T. W. Reps, S. Sagiv, R. Wilhelm: Verifying Temporal Heap Properties Specified via Evolution Logic. ESOP 2003: 204-222
- [74] T. W. Reps, S. Sagiv, R. Wilhelm: Static Program Analysis via 3-Valued Logic. CAV 2004: 15-30



Program transformation

Program transformation and optimization formalized a.o. as decorated abstract tree rewriting or functionally [75, 76, 77, 78, 79, 80, 81]



References

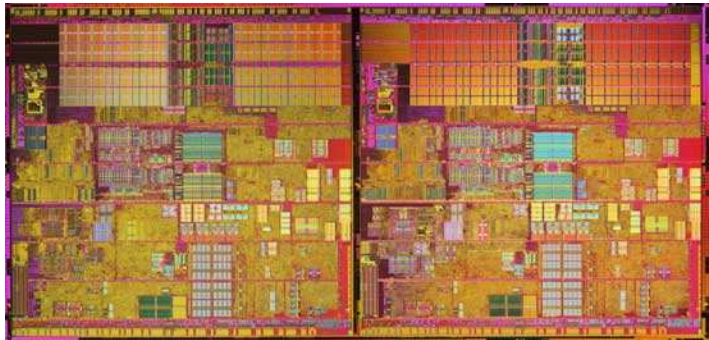
- [75] I. Glasner, U. Möncke, R. Wilhelm: OPTRAN, a Language for the Specification of Program Transformations. Fachtagung über Programmiersprachen 1980: 125-142
- [76] R. Giegerich, U. Möncke, R. Wilhelm: Invariance of Approximate Semantics with Respect to Program Transformations. GI Jahrestagung 1981: 1-10
- [77] R. Wilhelm: A Modified Tree-to-Tree Correction Problem. Inf. Process. Lett. 12(3): 127-132 (1981)
- [78] R. Wilhelm: Inverse Currying Transformation on Attribute Grammars. POPL 1984: 140-147
- [79] F. Warren Burton, D. Maurer, H.-G. Oberhauser, R. Wilhelm: A Space-Efficient Optimization of Call-by-Need. IEEE Trans. Software Eng. 13(6): 636-642 (1987)
- [80] P. Lipps, U. Möncke, R. Wilhelm: OPTRAN - A Language/System for the Specification of Program Transformations: System Overview and Experiences. CC 1988: 52-65
- [81] M. Alt, C. Fecht, C. Ferdinand, R. Wilhelm: Transformation Development: TrafoLa-H Subsystem. PROSPECTRA Book 1993: 539-576

Timing Analysis for Real-Time Systems



Processor models

What is the semantics of processors ? How to describe it ? Which real-time systems are time-predictable ? [82, 83, 84, 85, 86, 87, 88, 89]

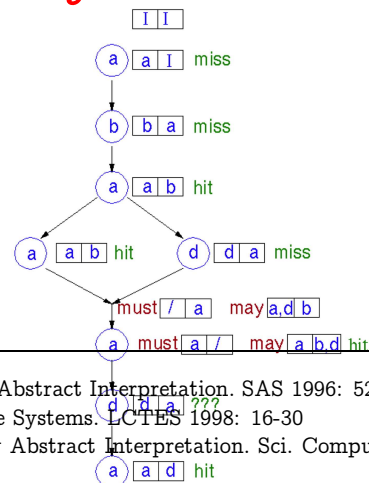


References

- [82] L. Thiele, R. Wilhelm: Perspectives Workshop: Design of Systems with Predictable Behaviour, 16.-19. November 2003 IBFI, Schloss Dagstuhl, Germany 2004
- [83] L. Thiele, R. Wilhelm: Abstracts Collection. Design of Systems with Predictable Behaviour 2004
- [84] L. Thiele, R. Wilhelm: Design for Time-Predictability. Design of Systems with Predictable Behaviour 2004
- [85] C. Berg, J. Engblom, R. Wilhelm: Requirements for and Design of a Processor with Predictable Timing. Design of Systems with Predictable Behaviour 2004
- [86] R. Wilhelm: Timing Analysis and Timing Predictability. FMCO 2004: 317-323
- [87] R. Wilhelm: Formal Analysis of Processor Timing Models. SPIN 2004: 1-4
- [88] L. Thiele, R. Wilhelm: Design for Timing Predictability. Real-Time Systems 28(2-3): 157-177 (2004)
- [89] R. Wilhelm: Run-Time Guarantees for Real-Time Systems. FORMATS 2003: 166-167

Cache Content Analysis

Static program analysis to determine what can be in the cache at runtime and when [90, 91, 92, 93, 94, 95]



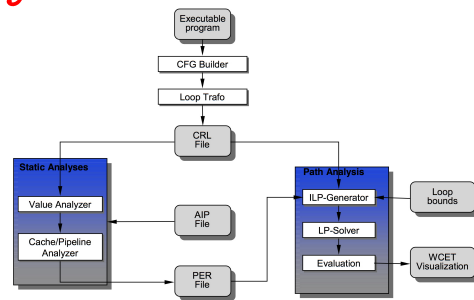
References

- [90] M. Alt, C. Ferdinand, F. Martin, R. Wilhelm: Cache Behavior Prediction by Abstract Interpretation. SAS 1996: 52-66
- [91] C. Ferdinand, R. Wilhelm: On Predicting Data Cache Behavior for Real-Time Systems. LCTES 1998: 16-30
- [92] C. Ferdinand, F. Martin, R. Wilhelm, M. Alt: Cache Behavior Prediction by Abstract Interpretation. Sci. Comput. Program. 35(2): 163-189 (1999)
- [93] C. Ferdinand, R. Wilhelm: Efficient and Precise Cache Behavior Prediction for Real-Time Systems. Real-Time Systems 17(2-3): 131-181 (1999)
- [94] H. Theiling, C. Ferdinand, R. Wilhelm: Fast and Precise WCET Prediction by Separated Cache and Path Analyses. Real-Time Systems 18(2/3): 157-179 (2000)
- [95] A. Rakib, O. Parshin, S. Thesing, R. Wilhelm: Component-Wise Instruction-Cache Behavior Prediction. ATVA 2004: 211-229



Timing analysis

Static program analysis to determine the worst-case running time of real-time programs [96, 97, 98, 99, 100, 101, 102, 103, 104]



References

- [96] R. Wilhelm: Why AI + ILP Is Good for WCET, but MC Is Not, Nor ILP Alone. VMCAI 2004: 309-322
- [97] S. Thesing, J. Souyris, R. Heckmann, F. Randimbivololona, M. Langenbach, R. Wilhelm, C. Ferdinand: An Abstract Interpretation-Based Timing Validation of Hard Real-Time Avionics Software. DSN 2003: 625-
- [98] C. Ferdinand, D. Kästner, F. Martin, M. Langenbach, M. Sicks, S. Wilhelm, R. Heckmann, Nico Fritz, S. Thesing, F. Fontaine, H. Theiling, M. Schmidt, A. A. Evstiougov-Babaev, R. Wilhelm: Validierung des Zeitverhaltens von kritischer Echtzeit-Software. GI Jahrestagung (1) 2003: 335-339
- [99] C. Ferdinand, R. Heckmann, H. Theiling, R. Wilhelm: Convenient User Annotations for a WCET Tool. WCET 2003: 17-20
- [100] R. Wilhelm, J. Engblom, S. Thesing, D.B. Whalley: Industrial Requirements for WCET Tools - Answers to the ARTIST Questionnaire. WCET 2003: 39-43
- [101] R. Heckmann, M. Langenbach, S. Thesing, R. Wilhelm: The influence of processor architecture on the design and the results of WCET tools. Proceedings of the IEEE 91(7): 1038-1054 (2003)
- [102] C. Ferdinand, R. Heckmann, M. Langenbach, F. Martin, M. Schmidt, H. Theiling, S. Thesing, R. Wilhelm: Reliable and Precise WCET Determination for a Real-Life Processor. EMSOFT 2001: 469-485
- [103] C. Ferdinand, D. Kästner, M. Langenbach, F. Martin, M. Schmidt, Jörn Schneider, H. Theiling, S. Thesing, R. Wilhelm: Run-Time Guarantees for Real-Time Systems - The USES Approach. GI Jahrestagung 1999: 410-419
- [104] R. Wilhelm: Timing Analysis and Validation for Real-Time Systems - Guest Editor's Introduction. Real-Time Systems 17(2-3): 127-129 (1999)

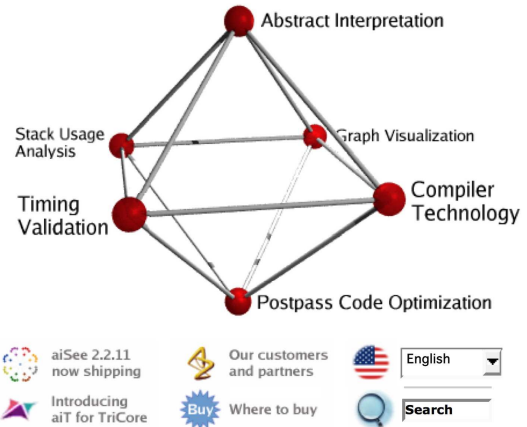
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A talent for industrialization



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From original research to successful industrialization [105]



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A talent for collaboration



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A talent for friendship



Reinhard's friends



Reinhard's friends



and many, many more...



The end, bravo Reinhard

Reinhard on the web: rw4.cs.uni-sb.de/~wilhelm/wilhelm.html.



Laudatio für R. Wilhelm, June 11th, 2006

