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Professor Ugo Montanari
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Dear Porfessor Montanari,

The Conflict-free Reduction Geometry
Z. Khasidashvili and J. Glauert

I enclose three copies of a paper submitted for publication in TCS.

This is a substantial revision of a paper that was submitted to you quite some time ago when it was not thought ready for publication. However, referees made a number of helpful suggestions for how the paper might be reorganised. We have followed their advice closely in most respects and believe that the paper submitted here is much improved as a result.

We would be grateful if you would consider this paper for publication, using the same reviewers if appropriate. It might be helpful to circulate the earlier reports to reviewers in order that they can understand the changes we have made. In addition, I attach some notes explaining the major changes. To highlight alterations in the text we have use a sans serif font. Naturally these sections will be replaced by standard fonts in the final version.

We look forward to consideration of this paper.

Yours sincerely,

Dr. J.R.W. Glauert

Notes for Reviewers on Revision of "The Conflict-free Reduction Geometry" by Z. Khasidashvili and J. Glauert

We have revised the paper by taking into account all the suggestions of the referees and the editor. Here we describe the main changes. These and all other changes are marked in the revised version, which we hope will simplify the referees (and the editor's) work. We would like to thank both referees for careful reading, and for very constructive suggestions, which we believe we have followed very closely and accurately.

- Following both referees requests, we have significantly reduced Sections 2 and 3.1 by removing definitions of concepts that were not essential for the understanding of the paper. For example, Theorem 15 in section 2 of the previous version now appears as Theorem 5, and the former Theorem 24 in subsection 3.1 now appears as Theorem 13.

- We have added the definition of Deterministic Erasure Event Structures (DEESs) to Section 3. At the end of subsections of sections 3 and 4, we have added descriptions of the introduced concepts in terms of events (as distributivity semantics). Because of erasure, conventional Prime Event Structures are inadequate for our purpose. This change was suggested by the first referee as one of two alternatives that would enable acceptance of the paper.

  [The other alternative was to drop Section 2 and part of Section 3, and adapt the paper as a technical note. We have chosen the first option because we agree with the referee in that interpretation of our construction in terms of events helps in the understanding of the whole decomposition theory, and supports our claim of distributedness offered by our "Geometry metaphor" (using the terminology of the referee). This also makes explicit the connection between the ES and Geometric approaches: the ES semantics is the basic one, and the Geometric approach develops it further.]

- We have slightly simplified the definition of relativized geometry (without changing the concept): We no longer use stable embeddings, and have omitted definitions of S-distance and S-independence degree in the definition of the relativized geometry since they are not used in the remainder of the paper. We have also slightly simplified the definition of stable sets of results (we define them as closed under reduction, and do not introduce closure under parallel moves; this loses a little precision, but is much simpler and more intuitive).

- At the end of Section 5, we have added a new theorem that shows that the decomposition results are not restricted to non-duplicating systems, or to complete-family reductions in duplicating systems, when one wants to compute (partial) normal forms in a stable set S. S-independent sets can be computed by any reduction (not necessarily by family-reductions), and the intermediate results can then be combined to yield a final result. This addresses one of the three main requests of the second referee. The two other requests (simplicity, minimization of concepts, and clarity) are addressed by the changes in Sections 2 and 3, mentioned above.

- We have made appropriate changes to address all the detailed comments of the second referee. Here we answer the questions of that referee that are not explicitly addressed in the paper:
  - The standardization algorithm may indeed not terminate for infinite reductions. In this case, the algorithm constructs an infinite reduction.
  - All characterizations of Lévy-equivalence via families are indeed necessary in the remainder of the paper. In fact, in some sense, this translation allows us to

(implicitly) perform some of the proofs in DEESs, since we can forget about the order of reduction steps, up to causal dependency.

- The algebraic properties in Lemma 44 (currently, Lemma 34) are used in the proof of Theorem 38 (the main result of Section 3). Further, an immediate corollary of the lemma allows construction of finer bases from existing ones, and shows existence of a finest basis. See remarks after the Independent Decomposition Theorem, Section 4.

- SDom(P) is exactly the set of redexes whose residuals are contracted in P. It follows that SDom(P) is uniquely defined for every P. It follows also that MDom(P) is the minimal set of redexes U such that every reduction Le'vy-equivalent to P is internal to U.

- In Definition 51 (currently, Definition 43), we indeed mean that a redex is erased when it is contracted. We use the term "discards" to indicate that a redex is erased by contraction of another redex: if u discards v, then u erases v, but is distinct from v. See current Definition 9. The definition of the "discards" concept was missing in the previous version, although it was used there (once). We have introduced it in the current version to emphasize the difference between "discards" and "erases".

- We hope that the new theorem in Section 5 emphasizes further the importance/usefulness of the concept of relativized geometry and the related results.

Zurab Khasidashvili
John Glauert