TITLE: "Safety Problems are NP-complete for Flat Integer Programs with Octagonal Loops"

ABSTRACT: This paper proves the NP-completeness of the reachability problem for the class of flat counter machines with difference bounds and, more generally, octagonal relations, labeling the transitions on the loops. The proof is based on the fact that the sequence of powers $\{R^i\}_{i=1}^\infty$ of such relations can be encoded as a periodic sequence of matrices, and that both the prefix and the period of this sequence are $2^{\mathcal{O}(\bin{R})}$ in the size of the binary encoding $\bin{R}$ of a relation R. This result allows to characterize the complexity of the reachability problem for one of the most studied class of counter machines, and has a potential impact for other problems in program verification.

Joint work with Marius Bozga (Verimag) and Filip Konecny (EPFL).