

# Disjunctive Completion Is Not “Optimal”

**Helmut Seidl**

FB IV - Informatik, University of Trier, Germany,  
seidl@uni-trier.de

**Christian Fecht**

Department of Computer Science, Universität des Saarlandes,  
Saarbrücken, Germany, fecht@cs.uni-sb.de

Enhancing ordinary analysis of Prolog with abstract domain  $D$  by using disjunctive completion  $\mathcal{P}(D)$  instead of  $D$  [1] may gain precision, but still is at most as precise as abstract OLDT-resolution with  $D$  [2, 3]. While OLDT with  $\mathcal{P}(D)$  gains nothing over OLDT with  $D$ , we give an example which proves that ordinary analysis with  $\mathcal{P}(D)$  may *lose* information against OLDT with  $D$  and hence cannot be “optimal”. Consider program:

$$\begin{array}{ll} s(X, Y, Z) \leftarrow a(X, Y, Z), p(X, Y, Z). & a(X, Y, Z) \leftarrow X = Y. \\ p(X, Y, Z) \leftarrow . & a(X, Y, Z) \leftarrow Y = Z. \end{array}$$

for query  $s(X, Y, Z)$  and assume we would like to compute *pair-sharing* information with pair-sharing domain PS of Søndergaard [4]. The possible sharing arriving before the call to  $p$  is given between  $X$  and  $Y$  or  $Y$  and  $Z$ , respectively. OLDT-resolution for the call to  $p$  propagates these two values separately and therefore returns just these values also for the program point behind the call to  $p$ . On the contrary, ordinary analysis using  $\mathcal{P}(PS)$ , cannot propagate the two values separately. Instead, it *combines* all possible return values for  $p$  with all possible values *before* the call. Therefore, it introduces a further possible sharing, namely between  $X$  and  $Z$  – and thus loses precision.

## References

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- [4] Harald Søndergaard. An Application of Abstract Interpretation of Logic Programs: Occur Check Reduction. In *ESOP'86*, 327–338. LNCS 213, 1986.