

## Completeness and Performance of the APO Algorithm

Tal Grinshpoun  
Amnon Meisels  
*Ben-Gurion University of the Negev*  
*Department of Computer Science*  
*Beer-Sheva, Israel*

grinshpo@cs.bgu.ac.il  
am@cs.bgu.ac.il

### Abstract

Asynchronous Partial Overlay (APO) is a search algorithm that uses cooperative mediation to solve Distributed Constraint Satisfaction Problems (DisCSPs). The algorithm partitions the search into different subproblems of the DisCSP. The original proof of completeness of the APO algorithm is based on the growth of the size of the subproblems. The present paper demonstrates that this expected growth of subproblems does not occur in some situations, leading to a termination problem of the algorithm. The problematic parts in the APO algorithm that interfere with its completeness are identified and necessary modifications to the algorithm that fix these problematic parts are given. The resulting version of the algorithm, Complete Asynchronous Partial Overlay (CompAPO), ensures its completeness. Formal proofs for the soundness and completeness of CompAPO are given. A detailed performance evaluation of CompAPO comparing it to other DisCSP algorithms is presented, along with an extensive experimental evaluation of the algorithm's unique behavior. Additionally, an optimization version of the algorithm, CompOptAPO, is presented, discussed, and evaluated.