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Cultural Algorithms: Emerging Social Structures for the Solution of Complex Optimization Problems

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Abstract: The Cultural Algorithm?s theme is distinguished by extracting problem solving knowledge and beliefs during the evolution procedure of the population in the form of structured and clustered schemata that can be used later, effectively, to direct the search process. The interaction of the knowledge reactors in the belief component engenders emergent phases of problem solving that replicates a branch and bound optimization algorithm. Such emergent phases lead to the appearance of distinguished function for the searching agents within the population; consequently a controlled organization of swarms at the population level. Therefore, knowledge swarms become evident in the belief space. This paper extends the Cultural Algorithms framework by enhancing it with diversified social networks that use seeds of knowledge at the belief space to resolve complex mechanical design optimization problems in an efficient and effective method. Several configurations of such networks are tested to examine the efficient level at which it can solve such complex constrained problems. The algorithm is used to solve challenging engineering and global optimization problems and is compared to other well-known algorithms from literature to show its efficiency. The results suggest that the emergent social structures provide the system with the ability to adapt during the course of searching the problem landscape for the optimal.