ABSTRACT

Two typical steps on a platform-based NoC project are the IP assignment and the IP mapping. These are highly complex steps and the use of platform-based EDA tools is essential in such cases. The IP assignment step is when the best set of IPs is assigned of executing a given application. The selection of the best set of IPs, capable to execute the given application, is driven by applications features and by IPs features. The IP mapping step is when the selected IPs are disposed in the NoC platform. Considering the communication among IPs and the target platform, the best mapping is chosen. These stages of design problems are considered highly complex and difficult to be solved even by computational tools. In this dissertation, the best set of IPs and the best mapping will be those that occupy the smallest area, have the lowest energy consumption and perform a specific application in the shortest time possible. To find solutions that achieve these goals, we propose an evolutionary IP assignment and an evolutionary IP mapping, using multi-objective evolutionary algorithms. These algorithms are based on a stochastic technique of search and optimization aimed to multi-objective optimization problems, such as the assignment and mapping problems. The chosen algorithms are the NSGA-II and microGA. In the evolutionary IP assignment step, these algorithms receive the IP data, obtained from a repository, and the data about the application tasks, obtained from the application's task graph. From the combination of these data, arise individuals that represent solutions to the problem and will be subjected to genetic operators. In the evolutionary IP mapping step, these algorithms receive the assignment of IPs obtained from the previous step and data from the network platform wherein the assignments will be mapped. To preserve the characteristics of the solutions acquired during the stage of assignment, a shift crossover, based on the biological mechanism of parthenogenesis, and an inner mutation operators are proposed. Factors that have an impact on the performance of the embedded network are analyzed and used to evaluate the solutions obtained by both algorithms. The obtained results are competitive with the results obtained by existing mapping tool. A comparison of performance between the implementations of NSGA-II and microGA is performed based on the amount of optimal assignments and mappings obtained and the search time spent by each algorithm.

Keywords: network-on-chip, IP assignment, IP mapping, multi-objective optimization, genetic algorithms.