Single-solution Simulated Kalman Filter Algorithm for Routing in Printed Circuit Board Drilling Process

Nor Hidayati Abdul Aziz[1,2], Zuwairie Ibrahim[2], Nor Azlina Ab Aziz[1], Zulkifli Md Yusof[3], and Mohd Saberi Mohamad[4]

[1] Faculty of Engineering and Technology, Multimedia University, Melaka, Malaysia
[2] Faculty of Electrical and Electronics Engineering, Universiti Malaysia Pahang, Malaysia
[3] Faculty of Manufacturing, Universiti Malaysia Pahang, Malaysia
[4] Faculty of Creative Technology and Heritage, Universiti Malaysia Kelantan, Malaysia

Abstract. Single-solution Simulated Kalman Filter (ssSKF) is a new optimizer inspired by the Kalman filtering process. This paper reveals the potential of ssSKF as a good routing method in printed circuit board (PCB) drilling process. Experimental results indicate that the ssSKF algorithm outperforms the existing methods in searching a good route to speed up a PCB drilling process.

Keywords: Simulated Kalman Filter, Printed Circuit Board, Routing.

1 Introduction

Simulated Kalman Filter (SKF) [1,2] is a population-based optimizer inspired by the Kalman filtering process. Recently, it is found that the SKF optimizer can also operates using only a single agent. This optimizer is called single-solution SKF (ssSKF) [3]. An advantage of the ssSKF is that it only requires one parameter tuning, whereas in SKF, determination of initial value, error covariance, and noise statistic should be done properly to get good results.

Routing is a process to find the best path. A lot of applications involve routing. In this paper, routing in printed circuit board (PCB) drilling process is studied. Consider a 14-hole PCB workpiece 100 mm in length and 70 mm in width as shown in Figure 1 [4]. The optimal length to drill all the 14 holes is 280 mm. These sequences and their reverse sequences lead to the optimal length: 2-3-4-7-8-13-14-10-11-12-9-6-5-1 and 10-11-12-9-6-5-1-2-3-4-7-8-13-14). However, there are 14!/2 = 43 589 000 000 possible sequences are available. Thus, finding the optimal route is a challenging task. While brute force approach requires computation of all possible paths, optimization-based approaches which require less computation are preferred. Up to date, a number of optimizers have been studied to solve this problem, such as global convergence particle swarm optimization (PSO) [4], global convergence PSO with decreasing inertia weight [5], ant colony system (ACS) [6], cuckoo search (CS) [7], and population-based SKF algorithm [8].