

HPC for Cyber Physical Social Systems (CPSS) by Using Evolutionary Multi-Objective Optimization Algorithm

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Literature Survey

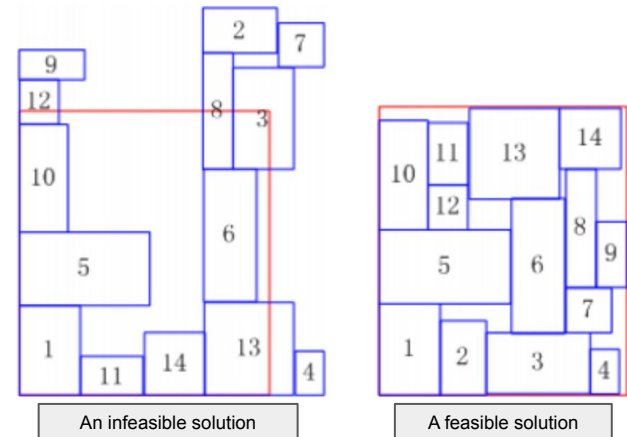
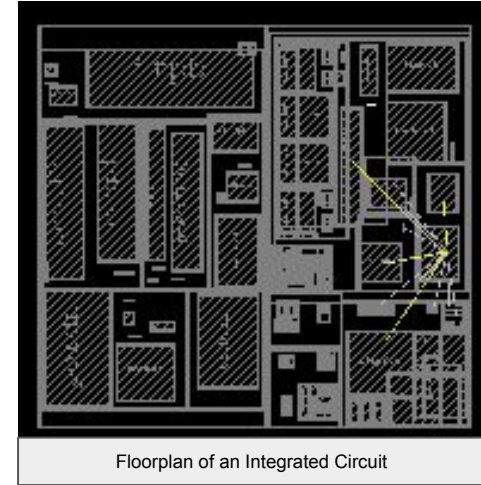
- CPSS is still in its infancy, with the term itself being coined as recently as 2006.
- M. Alwan, in 2006, described a study designed to assess the impacts of monitoring technology in assisted living. Monitoring systems were installed in 22 assisted living units to track the activities and critical alert conditions of residents. Activity reports and alert notifications were sent to professional caregivers who provided care to residents participating in the study.
- Beryl Plimmer, in 2013, presented McSig, a system for teaching blind children cursive handwriting so that they can create a personal signature. McSig aids the teaching of signatures by translating digital ink from the teacher's stylus gestures into a haptic pen that mimics the stylus movements. By the end of ten lessons with this system, two out of three children could form a repeatable signature.

Introduction

- A Cyber Physical System (CPS) is a system in which a physical mechanism is controlled or monitored by computer-based algorithms. This enhances the precision of the physical mechanism. Examples of such systems are smart grids, water and sewage networks, autonomous automobile systems, and autopilot avionics.
- A CPS, when combined with social factors becomes a CPSS. Example of such a system: Monitoring systems in healthcare sector which track the activities and conditions of residents.
- Most of the problems in this field can be modelled as multi-objective optimisation problems (MOPs) which are difficult to solve by traditional methods and require high performance computing. As CPSS is still an emerging domain, there is no general method to solve problems.
- In our paper, a general-purpose high-performance computing framework using evolutionary multi-objective optimisation algorithm has been proposed.

Brief of the problem

- Since most of the problems in this field are modelled as MOPs, a demonstration is done using the floorplanning problem.
- In the problem, we need to fit a certain number of blocks (dimensions known) on a board of known dimensions so that the amount of dead space or unused space doesn't exceed a certain percentage of the total space.



Proposed Methodology

- Python will be used for implementation. The chromosomes for the EA will be represented as a string of 1s and 0s.
- A large population of chromosomes will be randomly generated, then the mating pool will be selected using a selection technique. Then the processes of mating, crossover and mutation will be done on the mating pool. Chromosome performance will be judged using a cost function.
- First, we will run the program without parallel computing and evaluate the time. Then, parallel computing (using multiprocessing module) will be done.
- Speedup will be demonstrated by comparing the time taken for each approach.