CLAIMS

1. A method of scheduling a set of non-preemptive tasks in a multi-robot environment, the method comprising a processor implemented steps of:

defining, by one or more hardware processors, a plurality of tasks, wherein each the plurality of tasks is a non-preemptive task characterized by an execution time, a specified time interval for completing the non-preemptive task and a performance loss function per time unit;

partitioning, by a scheduling technique, the plurality of tasks into a set of schedulable tasks and a set of non-schedulable tasks, wherein the set of schedulable tasks comprise a subset of tasks to be executed within a predefined time interval and having a maximum performance loss value, and wherein the set of non-schedulable tasks comprise a subset of tasks failing to execute within the predefined time interval and with a low performance loss value; and

scheduling, in a pre-defined order, the plurality of tasks partitioned by performing a plurality of steps~~,~~, wherein the step of scheduling the plurality of tasks partitioned comprises performing, based upon the one or more performance loss values corresponding to the plurality of tasks, a load balancing of the plurality of tasks partitioned, to optimize the scheduling of the set of non-preemptive tasks in the multi-robot environment, and

wherein the plurality of steps comprise:

(i) sorting, by the scheduling technique, the plurality of tasks partitioned in non-increasing order of the one or more performance loss values corresponding to the plurality of tasks partitioned;

(ii) scheduling the set of schedulable tasks in the multi-robot environment by assigning at least one of the set of schedulable tasks to each robot amongst a plurality of robots operating in the multi-robot environment by implementing a compaction mechanism, wherein the scheduling comprises:

(a) determining, by the scheduling technique, a possibility of execution of each of the set of schedulable tasks in the multi-robot environment;

(b) determining, by the scheduling technique, a possibility of scheduling a set of pre-assigned tasks amongst the plurality of robots, wherein the set of pre-assigned tasks comprise one or more tasks other than the set of schedulable tasks and the set of non-schedulable tasks; and

(c) scheduling, by the compaction mechanism, the set of schedulable tasks in the multi-robot environment upon determining the possibility of execution of each of the set of schedulable tasks and the possibility of scheduling the set of pre-assigned tasks; and

(iii) scheduling, by a list-scheduling technique, the set of non-schedulable tasks amongst the plurality of robots.

2. The method of claim 1, wherein the step of scheduling the set of schedulable tasks comprises categorizing, by the scheduling technique, one or more schedulable tasks amongst the set of schedulable tasks as a non-schedulable task upon determining either one of:

(i) a least possibility of the execution of each of the schedulable task amongst the set of schedulable tasks; or

(ii) a least possibility of scheduling the set of pre-assigned tasks.

3. The method of claim 1, wherein the load balancing comprises:

(i) a re-arrangement of one or more schedulable tasks and one or more non-schedulable tasks based upon an identical performance loss value, wherein the one or more schedulable tasks and the one or more non-schedulable tasks correspond to the set of schedulable tasks and the set of non-schedulable tasks respectively; and

(ii) an identification of the one or more non-schedulable tasks with a maximum priority value from the set of non-schedulable tasks by implementing the scheduling technique to schedule the set of non-preemptive tasks in the multi-robot environment.

4. The method of claim 3, wherein the identical performance loss value corresponds to each of the one or more schedulable tasks and the one or more non-schedulable tasks, and wherein the one or more schedulable tasks and the one or more non-schedulable tasks correspond to the set of schedulable tasks and the set of non-schedulable tasks respectively

5. The method of claim 3, wherein the step of identification of the one or more non-schedulable tasks is performed iteratively by implementing the scheduling technique, until each the set of non-schedulable tasks is scheduled in the multi-robot environment.

6. A system for scheduling a set of non-preemptive tasks in a multi-robot environment, the system comprising:

a memory storing instructions;

one or more communication interfaces; and

one or more hardware processors coupled to the memory via the one or more communication interfaces, wherein the one or more hardware processors are configured by the instructions to:

define, a plurality of tasks, wherein each of the plurality of tasks is a non-preemptive task characterized by an execution time, a specified time interval for completing the non-preemptive task and a performance loss function per time unit;

partition, by a scheduling technique, the plurality of tasks into a set of schedulable tasks and a set of non-schedulable tasks, wherein the set of schedulable tasks comprise a subset of tasks to be executed within a predefined time interval and having a maximum

performance loss value, and wherein the set of non-schedulable tasks comprise a subset of tasks failing to execute within the predefined time interval and with a low performance loss value; and

schedule, in a pre-defined order, the plurality of tasks partitioned by performing a plurality of steps~~,~~, wherein the one or more hardware processors are configured to schedule the plurality of tasks partitioned by performing, based upon the one or more performance loss values corresponding to the plurality of tasks, a load balancing of the plurality of tasks partitioned, to optimize the scheduling of the set of non-preemptive tasks in the multi-robot environment, wherein the plurality of steps comprise:

(i) sort, by the scheduling technique, the plurality of tasks partitioned in non-increasing order of the one or more performance loss values corresponding to the plurality of tasks partitioned;

(ii) schedule the set of schedulable tasks in the multi-robot environment by assigning at least one of the set of schedulable tasks to each robot amongst a plurality of robots operating in the multi-robot environment by implementing a compaction mechanism, wherein the scheduling comprises, wherein the scheduling comprises:

(a) determine, by the scheduling technique, a possibility of execution of each of the set of schedulable tasks in the multi-robot environment;

(b) determine, by the scheduling technique, a possibility of scheduling a set of pre-assigned tasks amongst the plurality of robots, wherein the set of pre-assigned tasks comprise one or more tasks other than the set of schedulable tasks and the set of non-schedulable tasks; and

(c) schedule, by the compaction mechanism, the set of schedulable tasks upon determining the possibility of execution of each of the set of

schedulable tasks and the possibility of scheduling the set of pre-assigned tasks amongst the plurality of robots; and

(iii) schedule, by a list-scheduling technique, the set of non-schedulable tasks amongst the plurality of robots.

7. The system of claim 6, wherein the one or more hardware processors are configured to schedule the set of schedulable tasks by categorizing, via the scheduling technique, one or more schedulable tasks amongst the set of schedulable tasks as a non-schedulable task upon determining either one of:

(i) a least possibility of the execution of each of the schedulable task amongst the set of schedulable tasks; or

(ii) a least possibility of scheduling the set of pre-assigned tasks.

8. The system of claim 6, wherein the load balancing comprises:

(i) a re-arrangement of one or more schedulable tasks and one or more non-schedulable tasks based upon an identical performance loss value, wherein the one or more schedulable tasks and the one or more non-schedulable tasks correspond to the set of schedulable tasks and the set of non-schedulable tasks respectively; and

(ii) an identification of the one or more non-schedulable tasks with a maximum priority value from the set of non-schedulable tasks by implementing the scheduling technique to schedule the set of non-preemptive tasks in the multi-robot environment.

9. The system of claim 8, wherein the identical performance loss value corresponds to each of the one or more schedulable tasks and the one or more non-schedulable tasks, and wherein the one

or more schedulable tasks and the one or more non-schedulable tasks correspond to the set of schedulable tasks and the set of non-schedulable tasks respectively

10. The system of claim 8, wherein the one or more hardware processors are configured to perform iteratively, by implementing the scheduling technique, the step of identification of the one or more non-schedulable tasks, until each of the set of non-schedulable tasks is scheduled in the multi-robot environment.

11. One or more non-transitory machine readable information storage mediums comprising one or more instructions which when executed by one or more hardware processors cause:

defining, by one or more hardware processors, a plurality of tasks, wherein each the plurality of tasks is a non-preemptive task characterized by an execution time, a specified time interval for completing the non-preemptive task and a performance loss function per time unit;

partitioning, by a scheduling technique, the plurality of tasks into a set of schedulable tasks and a set of non-schedulable tasks, wherein the set of schedulable tasks comprise a subset of tasks to be executed within a predefined time interval and having a maximum performance loss value, and wherein the set of non-schedulable tasks comprise a subset of tasks failing to execute within the predefined time interval and with a low performance loss value; and

scheduling, in a pre-defined order, the plurality of tasks partitioned by performing a plurality of steps~~,~~, wherein the step of scheduling the plurality of tasks partitioned comprises performing, based upon the one or more performance loss values corresponding to the plurality of tasks, a load balancing of the plurality of tasks partitioned, to optimize the scheduling of the set of non-preemptive tasks in the multi-robot environment, wherein the plurality of steps comprise:

(i) sorting, by the scheduling technique, the plurality of tasks partitioned in non-increasing order of the one or more performance loss values corresponding to the plurality of tasks partitioned;

(ii) scheduling the set of schedulable tasks in the multi-robot environment by assigning at least one of the set of schedulable tasks to each robot amongst a plurality of robots operating in the multi-robot environment by implementing a compaction mechanism, wherein the scheduling comprises:

(a) determining, by the scheduling technique, a possibility of execution of each of the set of schedulable tasks in the multi-robot environment determining, by the scheduling technique, a possibility of scheduling;

(b) a set of pre-assigned tasks amongst the plurality of robots, wherein the set of pre-assigned tasks comprise one or more tasks other than the set of schedulable tasks and the set of non-schedulable tasks; and

(c) scheduling, by the compaction mechanism, the set of schedulable tasks in the multi-robot environment upon determining the possibility of execution of each of the set of schedulable tasks and the possibility of scheduling the set of pre-assigned tasks; and

(iii) scheduling, by a list-scheduling technique, the set of non-schedulable tasks amongst the plurality of robots.

12. The one or more non-transitory machine readable information storage mediums of claim11, wherein the step of scheduling the set of schedulable tasks comprises categorizing, by the scheduling technique, one or more schedulable tasks amongst the set of schedulable tasks as a non-schedulable task upon determining either one of:

(i) a least possibility of the execution of each of the schedulable task amongst the set of schedulable tasks; or

(ii) a least possibility of scheduling the set of pre-assigned tasks.