

OPERAS_{CC}: An instance of a Formal Framework for MAS Modelling based on Population P Systems

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Abstract

Swarm-based systems are biology-inspired systems which possess characteristics of multi-agent systems (MAS) with the most prominent ones being the local control over the decisions taken and their highly dynamic structure which continuously changes. This class of MAS is of a particular interest because it exhibits emergent behaviour through self-organisation and finds itself applicable to a wide range of domains. In this paper, we present *OPERAS*, an open formal framework that facilitates modelling of MAS, we describe how a particular instance of this framework, namely *OPERAS_{CC}*, could employ existing biological computation systems, such as Population P Systems, and demonstrate how the resulting method can be used to formally model a swarm-based system of autonomous spacecrafts.

1 Introduction

Lately, there has been an increasing interest toward biological and biology-inspired systems. From the smallest living elements, the cells, and how they form tissues in organisms to entire ecosystems and how they evolve, there is growing investigation on ways of specifying such systems. The intention is to create software that mimics the behaviour of their biological counterparts. Examples of biological systems of interest also include insect colonies (of ants, termites, bees etc.), flocks of birds, tumours growth—the list is endless. The understanding of how nature deals with various situations has inspired a number of problem solving techniques [10] that are applicable to a wide range of situations that had been puzzling computer scientists for decades. Swarm Intelligence and Ant