

Preface

In recent years, getting inspiration from simple but complex biological organisms, several advances have been seen in autonomous systems to mimic different behaviors that emerge from the interactions of a large group of simple individuals with each other and with the environment. Among several open issues a significantly important issue, not addressed so far, is the *self-sufficiency*, or in other words, the energetic autonomy of a modular robotic organism. This feature plays a pivotal role in maintaining a robotic organism's autonomy for a longer period of time.

To address the challenges of self-sufficiency, a novel dynamic power management system (PMS) with fault tolerant energy sharing is proposed, realized in the form of hardware and software, and tested. The innate fault tolerant feature of the proposed PMS ensures power sharing in an organism despite docked faulty robotic modules. Due to the unavailability of sufficient number of real robotic modules, a simulation framework called *Replicator Power Flow Simulator* is devised for the implementation of application software layer power management components. The simulation framework was especially devised because at the time of writing this work no simulation tool was available that could be used to perform power sharing and fault tolerance experiments at an organism level. The simulation experiments showed that the proposed application software layer dynamic power sharing policies in combination with the distributed fault tolerance feature in addition to self-sufficiency are expected to enhance the robustness and stability of a real modular robotic organism under varying conditions.

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Modular Robotic Organism

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