

Ricardo Franco Mendoza Garcia – “ A Heterogeneous Electronics Architecture for Dealing with Complexity in Modular Robots”

Abstract

Modular robots are built from many similar modules that can be combined in different shapes to suit tasks in hand. Although promising, current incarnations of this technology suffer of an important drawback: modules are usually extremely expensive. This thesis proposes an electronics architecture that addresses the price and complexity of modular robots by focusing on the good aspects of two popular approaches to build modular robots: homogeneous and heterogeneous designs.

Homogeneous designs are a single template of module that is replicated many times to provide a complete robot. This template is complex, but its production is easy. Heterogeneous designs are a small set of templates that are less-complex than homogeneous designs, but its production suffers from the diversity of templates that must be produced. Hence, this architecture tries to keep homogeneity as much as possible to reach easy production, but it is heterogeneous itself and supports the implementation of heterogeneous robots that are more capable than homogeneous counterparts. the architecture was implemented in four robots: Odin V1, Odin V2, Thor and Locomorph. In all cases, development time from conception to realization took less than a year, and two of these robots were able to take part in an international robot competition soon after their implementation. We conclude that heterogeneity brings three important advantages to the current stage of modular robots: it allows developers to move faster through design, implementation and test; to reuse hardware along design iterations; and to prototype robots with less amounts of hardware than homogeneous designs.