ABSTRACT

Extending the Growing Point Language to Self-Organise Patterns
in Three Dimensions

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GPL is used to engineer patterns of interconnect topologies on an amorphous computer. Previously it has been tested in 2-dimensional, but not 3-dimensional space. GPL breaks the spatial symmetry of the amorphous computing model by using a diffusion process that produces a radially symmetric spatial function that decreases monotonically with the distance from the source. Tropisms guide the movement (propagation) of a growing point (GP), relative to the level curves of these functions. A tropism that is tan - gential to a level curve constrains GP propagation to the a 1-D path, but does not specify a unique direction; an arbitrarily chosen initial direction coupled with a GPL simulation of inertia is necessary for that. Furthermore, in moving to 3-D the concentric circles of the level curves become concentric spheres. The GP is no longer restricted to the contour, but able to meander over the surface of the sphere with no predictability. We argue that the predictability of the geometric properties of GPL programs dependent on tangential tropisms can be recovered in 3-D by utilising a method to restrict the trajectories to a specified curve. We present two new GPL primitives that were developed to support the solution to this problem, along with an alternative definition for the tangential tropism. The first (backtracking) permits a growing point to revisit nodes along its trajectory, and the second implements propagation with inertia. We provide a quantitative comparison with previously employed techniques, discuss drawbacks of the new primitives, and suggest possible improvements. We considered four metrics when assessing the quality of circles produced: circularity, planarity, degree of completion and the accuracy of the radius.

Keywords: Alyssa Sadé Morgan; Amorphous Computing; Distributed Programming Languages; Spatial Computing; Self-organising Patterns; Swarm Intelligence.