



Geometric Typed Feature Structures: Toward *design space exploration*

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Dissertation

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0.1 Abstract

This thesis explores an extension to the concept of carrying geometric information based on the theory of Typed Feature Structures. We introduce this extension, Geometric Typed Feature Structures, as the focus of this thesis. Geometric Typed Feature Structures covers an important aspect of design space explorers where their symbol level representation carries 3D geometric information. Order Types are the devices in Geometric Typed Feature Structures that carry the continuous infinite domain information—that is, geometry. In this extension, theories and algorithms are applied to two kinds of Order Type examples for carrying numerical values and geometric information.

The thesis uses the concept of *exploration in design spaces* by presenting a knowledge level and its corresponding symbol level representation. An informal equation of five concepts illustrates the design space exploration model and its falsification test—design space explorers. Realisations of the exploration model and of design space explorers are undertaken by creating coherent systems at both symbol and the human-computer interface (HCI) levels.

Using a knowledge level (the SEED knowledge level) and its symbol level realisation using Typed Feature Structures, we present a domain extension of Typed Feature Structures for carrying geometric information: Geometric Typed Feature Structures. Geometric Typed Feature Structures uses the types (*Order Types*) as the carriers for geometric information and other continuous domain information. We describe the requirements as well as the conditions in which an Order Type can be specified and synchronised with other domain knowledge.

We show an implementation for our Geometric Typed Feature Structures: Ordering Geometry System. This implementation demonstrates the significance and usefulness of representation in geometry by generating various floor design layouts for a typical Australian house—a single fronted cottage and the building enclosures. Finally, advanced geometric representation in the HCI level is left for future work and further research which lies within the computational design domain.

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