A Comment on 'Constructing Regularity Feature Trees for Solid Models'

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In [2] we presented an algorithm for decomposing a boundary representation model hierarchically into regularity features by recovering broken symmetries. The algorithm adds new recoverable edges and faces, which can be constructed from existing geometry. This generates positive and negative volumes giving simple, more symmetric sub-parts of the model. The resulting regularity feature tree may be utilised for regularity detection to describe a model's design intent in terms of regularities such as symmetries and congruencies.

In that paper we cited Leyton [1]. It has been brought to our attention that we could have more fully acknowledged this important work in which Leyton extensively discusses design intent, based on the idea that constructing a geometric model can be described as a sequence of symmetry breaking operations. A generative model of an object's shape can be built based on these operations. He argues that the asymmetries present in a shape represent its design intent. Hence, design intent is represented in a generative model by a sequence of symmetry breaking opertions, which can be recovered from the generative representation.

Our approach starts with only a boundary representation model. As there are infinitely many construction sequences for such a model [3], we detect design intent only as regularities of the final model, and cannot infer its construction history. The regularity feature tree does not represent a construction history, but is only constructed to aid regularity detection. Leyton's work is mainly concerned with the representation of shape and the fact that design intent as a symmetry-breaking construction history can be recovered from a generative representation without the need for detection algorithms.

References

1. M. Leyton. *A generative theory of shape.* Lecture Notes in Computer Science 2145, Springer, Berlin, 2001.
2. M. Li, F. C. Langbein, R. R. Martin. Constructing Regularity Feature Trees for Solid Models. In: M.-S. Kim, K. Shimada (eds), *Proc. Geometric Modeling and Processing*, pp. 267–286, Lecture Notes in Computer Science 4077, Springer, Berlin, 2006.
3. V. Shapiro, D. Vossler. Separation for boundary to CSG conversion. *ACM Trans. Graphics*, 12(1):35–55, 1993.