Concluding remarks

We have studied the problem of determining whether there is a two-part cast for a given object such that the two cast parts can be removed without collision. We considered the case where the removal directions must be opposite, and gave necessary and sufficient conditions under which a cast exists. We also developed an algorithm to compute the cast for polyhedral objects, and the variant of this algorithm that we implemented performs fairly well in practice.

We have also studied two variants of the two-part cast problem: One of them is identical to the two-part cast problem, except that the cast machinery has a certain level of uncertainty in its directional movement. In the other one, two cast parts are to be removed in two given directions and these directions need not be opposite. For both problems, we gave complete characterizations under which a cast exists, and obtain algorithms to verify these conditions for polyhedral parts.

We defined a geometric feature, the *cavity*, which facilitates the process of analyzing manufacturability and the automated design of a cast for the object. We also provide algorithms to extract it from objects.

There are several interesting directions for further research.

While our implementation performs well on medium size models, more experimentation is necessary to develop a robust, practically useful, efficient heuristic implementation. Many objects in real life are not polyhedral, so the algorithm should be extended to handle more general object boundaries, such as cubic B-spline patches.

In Section 5.4, we provided an algorithm to construct a set of all possible pairs of directions in which the given polyhedral object is castable in time $O(n^{14}\log n)$. We consider a 4-dimensional parameter space, and construct a set of $O(n^3)$ algebraic surfaces whose arrangement has complexity $O(n^{12})$. Current algorithm takes $O(n^2\log n)$ time for each cell in the arrangement to test the castability. It would be a challenge to exploit the potential coherence between neighboring cells in order to reduce the complexity rather than paying $O(n^2\log n)$ per cell.

Another interesting issue is to study the extra possibilities that cores and inserts give.

Finally, it is desirable to maximize the "flatness" of the parting surface between the two cast parts. Majhi et al. [37] considered this problem for convex polyhedral objects. They proposed a "flatness" measure and gave an $O(n^2)$ time algorithm to find a cast that optimizes this measure, where n is the number of vertices. It would be interesting to see whether our algorithm for computing all directions of castability can be adapted so that it reports the direction allowing the flattest parting surface.