Models of Computation for Origami Science and Engineering

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I will discuss computation models of origami (paper fold). Origami construction, or simply origami, is akin to computing. Origami transforms geometric objects by a well-defined method of folding, whereas computing does on symbolic and numeric objects based on rigorous rules of computing. As in computing, we have the variety of views to look into the process of the transformations, and the guidance of the study is abundant. Naturally, the efforts of modeling the behavior are called for, since origami appears to be complicated enough to grasp its essence without abstraction. Most of us have an experience of failing to understand the recipe of origami and, as a result, of failing to obtain the intended origami artwork illustrated in the recipe. The reason for the failure is simple, when we see that the recipe of folding is a program. As computing programs are executed precisely according to the programmer's will in mind, so must be performed the origami folds.

Starting from this viewpoint, we can see the interesting scenery in front of us. The design of a scripting language for origami, the compilation of the origami language to a language of the predicate logic, then to the translation of a set of algebraic equalities/inequalities using rational geometry and the geometric algebra, and furthermore the transformation of algebraic expressions, all come into play. They must be properly encapsulated providing adequate levels of abstractions and communication between them.

Development of the computational origami system called Eos gave me an opportunity for making those into a complete picture rather than mosaic assembly.

I am hoping that origamists, if not mathematicians or computer scientists will find Eos interesting to apply to their daily activities. Perhaps, the advance of

computing technology pushes the application of Eos to more domains ranging from education to industrial manufacturing.

I worked on Eos for 15 years, preceded by the work of symbolic computation from the age of 24 to the present.   I can include failure and success stories about our endeavor.   I would also like to talk about the failure experiences.   Their values will come to be recognized since in those we can find more paths to future success for everyone.   I would like to place my talk somehow in my personal perspectives varying in time.