

5. Conclusions

In this paper, concepts of emergent design and optimum design, which are artifact designs applicable to the early and late design processes, are discussed. Specific conditions and design problems are demonstrated, and can be summed as follows:

- 1) Emergent design has a reciprocal interactive process, and is applicable to derive diverse design solution candidates where the design object and constraint conditions are unclear.
- 2) Optimum design is a top-down method, which derives part from the whole using clear design objects and constrained conditions.
- 3) Emergent design can be applied to the design problems when the design objective and the constraint condition are indefinite, and a global solution search and derivation of diverse solutions are needed. Moreover, optimum design can be applied to design problems when the design objective and the constraint condition are clear, and the local solution search and derivation of a unique optimum solution are needed.

Future work will use the emergent design concept to propose a specific design method.

References

- [1] Kitamura S. (1995) Emergent Systems-Toward a New Paradigm for Artificial Systems. Toward System Theory of Function Emergence. *Journal of the Society of Instrument and Control Engineers*, vol. 37, no. 7, pp 492-495.
- [2] Soufi B, Edmonds E. (1996) The Cognitive Basis of Emergence: Implications for Design Support. *Design Studies*, vol. 17, no. 4, pp 451-463.
- [3] Poon J, Maher M L. Co-evolution and Emergence in Design. *Artificial Intelligence in Engineering*, vol. 11, no. 3, pp 319-327.
- [4] Peter C. (1981) *Systems thinking, systems practice*. John Wiley & Sons: Hoboken.
- [5] Kauffman S. (1995) *The Search for Laws of Self-Organization and Complexity*. Oxford University Press: Oxford.
- [6] Collins R. J, Jefferson D. R. (1992) *Ant-Farm: Towards Simulated Evolution, in Artificial Life II*. Addison-Wesley: Old Tappan, pp 579-601.
- [7] Reynolds C. W. Flocks, Herds, and Schools: A Distributed Behavioral Model. *Comput Graph (N.Y.)*, vol. 21, no. 4, pp 25-34.