<u>PROCEEDINGS</u>

Implicit Surfaces Generated from Field Values Directly-Obtained from Scattered Points

Taku Itoh[1],*

[1]College of Industrial Technology, Nihon University, 1-2-1 Izumi-cho, Narashino, Chiba, 275-8575, Japan
*Corresponding Author: Taku Itoh. Email: itoh.taku@nihon-u.ac.jp

ABSTRACT

In meshless methods, although elements constructing an analysis domain are not required, the domain should be represented in some way, instead. A scalar field $g(\boldsymbol{x})$, that contains the analysis domain, is sometimes employed, and the boundary of analysis domain is represented as an implicit surface, $g(\boldsymbol{x}) = 0$. In this study, we consider generating an implicit surface from scattered points on the surface of an object. The scattered points are obtained by a three-dimensional scanning device. To generate $g(\boldsymbol{x})$, field values f_{ijk} on N^3 uniform grid points $\boldsymbol{x}_{ijk}$ are required. Although the field values f_{ijk} have been originally obtained from another scalar field $f(\boldsymbol{x})$ [1], they can be obtained from a set of scattered points directly by a method described in [2]. After field values f_{ijk} are obtained, the scalar field $g(\boldsymbol{x})$ is often constructed as a set of piecewise polynomials based on B-spline functions [1]. Note that, to represent the piecewise polynomial in each of cells in the grid, some coefficients of the piecewise polynomial must be stored on a device memory. For this reason, when N becomes large, the memory cost tends to be large. If the field values f_{ijk} can be interpolated without piecewise polynomial, the memory cost may be decreased. In this study, to directly interpolate the field values f_{ijk}, we focus on the isoparametric elements that have been employed in the finite element analysis. The purpose of this study is to present a method for generating implicit surface employing the isoparametric elements from field values directly-obtained from scattered points. Some kinds of isoparametric elements will be applied, the performance of each of them is compared. Results and discussions will be presented at the conference.

KEYWORDS

Implicit surface; meshless methods; field values; volume data; B-spline; isoparametric elements

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

References

1. Nakata, S., Aoyama, S., Makino, R., Hasegawa, K., Tanaka, S. (2012). Real-time isosurface rendering of smooth fields. *Journal of Visualization, 15(2)*, 179-187.
2. Itoh, T., Nakata, S. (2015). Fast Generation of Smooth Implicit Surface Based on Piecewise Polynomial. *Computer Modeling in Engineering & Sciences, 107(3),* 187-200.