Study of the Compact Support Size in Mesh Free Interpolation Methods for Data Transfer in Multi-Physics Problems.

Luis F. Paullo Muñoz* and Deane Roehl*

*Civil and Environmental Engineering Department / Institute Tecgraf
Pontifícia Universidade Católica do Rio de Janeiro
Rua Marquês de São Vicente 225, 22451-240 Rio de Janeiro, RJ, Brazil
e-mail: lfernand@tecgraf.puc-rio.br, deane@tecgraf.puc-rio.br

ABSTRACT

In the simulation of multi-physics problems under uncoupled or pseudo-coupled approaches, transfer of data between two non-matching meshes is difficult task. To guaranty accuracy and conservation of the results in such analyses, the use of appropriate interpolation methods is required. Methods based on mesh free interpolation have been largely used since those methods show good accuracy and conservation and are topology independent.

Several mesh free interpolations work with data contained in a source compact support defined by a characteristic distance known as compact support radius. In this work, the influence of the compact support radius used by mesh free interpolation methods for data transfer in uncoupled multi-physic problems is assessed. Two mesh free methods, the local Moving Least Square reconstruction and the Global Spline Interpolation, are used in parametric studies involving one-way and two-way data transfer. Numerical parametric examples integrate the study of accuracy and conservation errors with the compact radius support variation.

Additionally, an auto-search of the compact support radius scheme based on a minimum number of source points is proposed. The performance of the proposed methodology is studied in terms of accuracy and conservation errors. The numerical results show the high dependency of the transfer quality on the compact support size, especially in non-structured meshes. Examples with models that exhibit refined discretization regions show the existence of a reduced interval of values for the compact support radius where the maximum error is lower than 2.5%. The proposed auto-search radius scheme shows a more stable performance for a prescribed minimum number of points contained inside the compact support.

REFERENCES

[1] S.R. Slattery, “Mesh-free data transfer algorithms for partitioned multiphysics problems: Conservation, accuracy, and parallelism”, *Journal of Computational Physics*., Vol. **307**, pp. 164-188, (2016).