An a posteriori error estimator for analysis-based defeaturing IX International Conference on Adaptive Modeling and Simulation – ADMOS 2021

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ABSTRACT

Defeaturing consists in simplifying geometrical models by removing the geometrical features that are not relevant for simulation. For instance, in solid mechanics simulations, they can be holes or fillets away from stress concentration regions. Simplifying the geometry of a computer aided design (CAD) model by defeaturing enables more efficient simulations for engineering analysis problems: the resulting mesh is simpler, the computation faster, and less memory storage is needed [1]. However, the effects of defeaturing on the accuracy of the analysis are often neglected: it is a time-consuming task that is often performed manually and based on the expertise of engineers. Understanding well the effects of this process is an important step to be able to adaptively integrate design and analysis for CAD/CAE.

In this talk, we will formalize the process of defeaturing by understanding its effect on the solution of Laplace equation defined on the geometrical model of interest. More specifically, we have developed an a posteriori estimator of the energy error between the solutions of the exact and the defeatured geometries in $\mathbf{R}^2$ and $\mathbf{R}^3$ [2], that allows us to control the error made by adding or removing geometrical features. This defeaturing error estimator can also be combined with a numerical error estimator due to the numerical approximation of the problem at hand.

The dependence of the estimator upon the size of the features is explicit, and the effectivity index is independent from the number of features considered. This estimator is both reliable and efficient, it can be computed very efficiently, and it allows us to drive a refinement strategy that adaptively determines which geometrical features are needed in order to achieve a certain precision.

REFERENCES

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