ST Computational Analysis with Isogeometric Discretization

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ABSTRACT

This presentation is an overview of how NURBS basis functions in space and time are enabling Space–Time Computational Analysis (STCA) to bring solution to a diverse set of challenging engineering problems. With the integration of the core ST [1] and NURBS technologies, we not only increase what we can do with the ST methods [2] and how accurately we can do it, but we also get more out of using NURBS basis functions in space [3, 4]. Integration with additional ST technologies such as the ST Slip Interface [5] and ST Topology Change [6] methods further increase the scope and accuracy of our overall STCA technology [7, 8]. The examples presented will include engineering and biomedical problems.

REFERENCES

[1] K. Takizawa and T.E. Tezduyar, "Multiscale space–time fluid–structure interaction techniques", *Computational Mechanics*, **48** (2011) 247–267, doi: 10.1007/s00466-011-0571-z.

[2] K. Takizawa and T.E. Tezduyar, "Space–time fluid–structure interaction methods", *Mathematical Models and Methods in Applied Sciences*, **22** (supp02) (2012) 1230001, doi: 10.1142/S0218202512300013.

[3] K. Takizawa, T.E. Tezduyar, Y. Otoguro, T. Terahara, T. Kuraishi, and H. Hattori, "Turbocharger flow computations with the Space–Time Isogeometric Analysis (ST-IGA)", *Computers & Fluids*, **142** (2017) 15–20, doi: 10.1016/j.compfluid.2016.02.021.

[4] Y. Otoguro, K. Takizawa, and T.E. Tezduyar, "Space–time VMS computational flow analysis with isogeometric discretization and a general-purpose NURBS mesh generation method", *Computers & Fluids*, published online, 2017, doi: 10.1016/j.compfluid.2017.04.017.

[5] K. Takizawa, T.E. Tezduyar, H. Mochizuki, H. Hattori, S. Mei, L. Pan, and K. Montel, "Space–time VMS method for flow computations with slip interfaces (ST-SI)", *Mathematical Models and Methods in Applied Sciences*, **25** (2015) 2377–2406, doi: 10.1142/S0218202515400126.

[6] K. Takizawa, T.E. Tezduyar, A. Buscher, and S. Asada, "Space–time interface-tracking with topology change (ST-TC)", *Computational Mechanics*, **54** (2014) 955–971, doi: 10.1007/s00466-013-0935-7.

[7] K. Takizawa, T.E. Tezduyar, S. Asada, and T. Kuraishi, "Space–time method for flow computations with slip interfaces and topology changes (ST-SI-TC)", *Computers & Fluids*, **141** (2016) 124–134, doi: 10.1016/j.compfluid.2016.05.006.

[8] K. Takizawa, T.E. Tezduyar, T. Terahara, and T. Sasaki, "Heart valve flow computation with the integrated Space–Time VMS, Slip Interface, Topology Change and Isogeometric Discretization methods", *Computers & Fluids*, published online, November 2016, doi: 10.1016/j.compfluid.2016.11.012.