Title:	**'Finite Element Exterior Calculus' by Dr. Kaibo Hu (University of Oxford)**
Aimed at:	OxPDE/ CDT D. Phil students
Course Length:	2 hours with a comfort break for 4 weeks
Dates and Times:	27th Oct, 3rd Nov, 10th Nov, 17th Nov / 10:00 – 12:00 GMT
Location:	Lecture Theatre 3, Andrew Wiles Building

Course Overview

Many PDE models encode fundamental physical, geometric and topological structures. These structures may be lost in discretisations and preserving them on the discrete level is crucial for the stability and efficiency of numerical methods. The finite element exterior calculus (FEEC) is a framework for constructing and analysing structure-preserving numerical methods for PDEs with ideas from topology, homological algebra and the Hodge theory.

In this seminar, we present the theory and applications of FEEC. This includes analytic results (Hodge decomposition, regular potentials, compactness etc.), Hodge-Laplacian problems and their structure-preserving finite element discretisation, and applications in electromagnetism, fluid and solid mechanics. Knowledge on geometry and topology is not required as prerequisites.

Bibliography

[1] Arnold, D.N.: Finite Element Exterior Calculus. SIAM (2018). https://doi.org/10.1137/1.9781611975543

[2] Arnold, D.N., Falk, R.S., Winther, R.: Finite element exterior calculus, homological techniques, and applications. Acta Numerica 15, 1 (2006). https://doi.org/10.1017/S0962492906210018

[3] Arnold, D.N., Falk, R.S., Winther, R.: Finite element exterior calculus: from Hodge theory to numerical stability. Bulletin of the American Mathematical Society 47(2), 281–354 (2010) https://doi.org/10.1090/S0273-0979-10-01278-4

[4] Arnold, D.N., Hu, K.: Complexes from complexes. Foundations of Computational Mathematics (2021. https://doi.org/10.1007/s10208-021-09498-9

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