

# Flux aligned quad-meshes generation with complex topologies for a high precision computation within Isogeometric analysis

Meng Wu\*, Yuan Liu\*, Xuhui Wang\*, Boniface Nkonga‡, Bernard Mourrain†,  
,Gang Xu§

\* School of Mathematics, Hefei University of Technology, P. R. China  
e-mail: [meng.wu@hfut.edu.cn](mailto:meng.wu@hfut.edu.cn)

‡ Lab. J. A. Dieudonné, University of Nice, Nice, France  
Email: [boniface.nkonga@unice.fr](mailto:boniface.nkonga@unice.fr)

† Aromath, Inria, Sophia Antipolis, France  
Email: [Bernard.Mourrain@inria.fr](mailto:Bernard.Mourrain@inria.fr)

§School of Computer Science and Technology, Hangzhou Dianzi University, P. R. China  
Email: [gxu@hdu.edu.cn](mailto:gxu@hdu.edu.cn)

## ABSTRACT

In magneto hydrodynamic (MHD) simulation for Tokamaks, higher anisotropies of transport processes suggest the use of meshes aligned with the principal directions of the transport processes. To obtain high precision computation, it is necessary to generate flux aligned quad-meshes. However, the topologies of quad-meshes are not only determined by the topology of the physical domain, but also greatly influenced by the distribution of magnetic flux-surfaces. It is difficult to generate by an automated algorithm. In this talk, we will introduce the theory and algorithm to address this problem.

First, a strict mathematical theory is introduced to prove the existence of a flux aligned quad-mesh;

Second, we develop a geometric algorithm to generate flux aligned quad-meshes;

Third, several examples are illustrated to show the effectiveness of the algorithm.