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Removing bottlenecks in geophysical finite element modelling through advanced hexahedral meshing

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With increasing computational power and advanced developments of numerical codes for geophysical finite element modelling, the usage of such methods is becoming increasingly common and convenient from a users perspective. However, one processing step is becoming more and more of a bottleneck and requires substantial amount of user interaction: the generation of high quality hexahedral meshes. To date the community either uses highly specialized codes in very specific domains or much more flexible proprietary software from the engineering domain which requires a substantial amount of manual interaction even for relatively simple meshes.

In this talk we plan to raise the profile of this issue. In fact, the domains used in the geosciences are often simple from a topological point of view but more care is required with respect to element size and quality. For this reason, the community needs to take responsibility for the meshing process and develop adapted meshing strategies, which also enables new and exciting applications. To highlight this, we present the salvus meshing toolbox that provides fully automatized meshing for the most popular problems in seismology, but also provides flexibility through a Python API. We highlight the functionality by a variety of examples ranging from exploration to global seismology, dynamic rupture, homogenization, gravity and tidal deformation modelling but also including ultrasonic wave propagation for breast cancer imaging.