Comparison of Hexcore and Poly-Hexcore computational grids in the aspect of air flow modeling based on the actual geometry of mining excavations

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Discrete models are used in industry for many applications. In one of the most frequently used Finite Element Method (FEM) for Computational Fluid Dynamics (CFD) calculations, these models may be two-dimensional or three-dimensional [1]. 2D models are used as a simplification to achieve satisfied results in the shortest computational time. 3D models, on the other hand, are used for more complex calculations. These models use real-world models that have been appropriately simplified to make the calculations accurate and correct. The calculation time of a 3D model is significantly longer compared to a 2D. For this reason, to reduce the calculation time, different types of simplifications and various types of discrete model meshes are used. In this paper, the authors performed a comparison of two types of computational grids: Hexcore and Poly-Hexcore in the aspect of airflow modeling in mining excavations using CFD. The geometry considered in this case came from real-world models captured in Polkowice-Sieroszowice Mine, Poland by laser scanning. Point cloud data was processed through feature extraction which was subsequently utilized to create structured models of mining excavations. The results of the simulations show that taking into account such a diverse and complicated geometry and its significant lengths, reaching tens of kilometers, better results are obtained with the use of Poly-Hexcore mesh. This mesh type allows simulations to be performed with similar accuracy, however, in a shorter computation time. Utilization of a more modern type of mesh makes work more dynamic, which is of particular importance when conducting numerical simulations of air distribution in large and complex computational domains.