Modeling the Cooling Air Flow in an Electric Generator

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Hydroelectric power generation is of high importance in Sweden, as almost half of the electricity production in the country depends on hydroelectric powerplants. Cooling of the hydro power generators is a main design concern as it affects both the efficiency of the powerplants in delivering electricity as well as the lifetimes of certain generator components, such as paper insulations.

In this work the air flow inside an electric generator has been modeled to further be used in heat transfer simulations. Different rotor and stator layouts have been tested and the results compared to each other. The OpenFOAM results have also been validated against experiments, and the comparisons will be presented in this work.

The numerical results will be presented for both steady-state and unsteady cases. The turbulence has been modeled using the low-Re Launder-Sharma $k - \varepsilon$ turbulence model and the computational domain is generated fully parameterized in blockMesh. Figure 1 shows the generator in the present work. The front parts of the stator have been made transparent to allow for a better understanding of the geometric details.

Figure 1: The generator used in the computations. The front parts of the stator have been made transparent to allow for a better understanding of the geometric details.

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References
