Gust Response of a Porous Wing

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ABSTRACT

The objective of the present project aims to provide a review of the aerodynamic disturbances related to the gust response of a porous wing using OpenFOAM. This investigation includes a transitional Reynolds numbers (Re) to visualize the flow pattern and analyze the aerodynamic force coefficients such as lift and drag. The dimensions of the wings are considered to be two-dimensional with a specific porosity pattern positioned at an angle. The analysis of the porous wing is compared with a traditional flat plate wing to study the comparison of the wing structures under turbulent regimes. This investigation also includes the airflow optimization characteristics by the porous wing under gust conditions. To imitate the gust characteristics, sinusoidal velocity has been introduced within the simulation. Boundary conditions such as 'uniformFixedValue' and 'codedFixedValue' allows for an intense analysis of the respective wing structures. The geometry and mesh were generated by using the 'blockMesh' utility. The laminar flow was solved using the pimpleFOAM solver which adds to the stability and accuracy of the simulation approach. Obtained results are validated with the analytical results available in the literature.
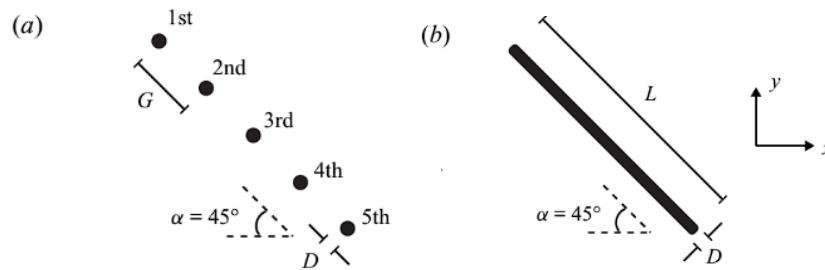
Figure1: Geometry of (a) Porous Wing (b) Flat Plate Wing