CERTIFICATION OF APPROVAL

Experimental and Numerical Investigation on 2-D Wing-Ground Interference

by

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Approved by,

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ABSTRACT

The wing collision is a practical aerodynamic problem. All aerodynamics characteristic of the wing are changing in the collision phenomena. In the present project, the collision of 2-D airfoil section with ground will be investigated experimentally and numerically. The study includes a series of wind tunnel experiments to investigate the 2-D wing influence under collision. Numerical simulation by CFD has been carried out using FLUENT software in order to identify the changes of aerodynamics characteristics during the wing collision. The 2-D wing section selected for the study is NACA 4412 airfoil. The investigation has been carried out at different Reynolds Number ranging from (0.1×10^6 to 0.4×10^6), different angles of attack (-4^0 to 20^0) and different height above the ground.

Based on take off and landing fly stages the boundary conditions for the experimental and numerical analysis are determined. An experimental set up was designed and constructed to simulate the collision phenomena in a subsonic wind tunnel. The results of the airfoil characteristic are presented in non-dimensional form as lift, drag and pitching moment coefficient.

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NOMENCLATURE

NACA 4412	**Aircraft Wing Section Model**
CFD	**Computerized Fluid dynamics**
Re	**Reynolds Number**
α	**Angle of Attack**
ρ	**Density of Air**
μ	**Viscosity of Air**
V	**Fluid Velocity**
C_L	**Lift Coefficient**
C_M	**Moment Coefficient**
C_D	**Drag Coefficient**
C	**Chord Length**
L	**Lift Force**
M	**Pitching Moment**
D	**Drag Force**
H	**Height (between the Chord Line and the Ground)**
S	**Projected Area**
L / D	**Lift to Drag Ratio**
H / C	**Height to Chord Ratio**
SDGE	**Span Dominated Ground Effect**
CDGE	**Chord Dominated Ground Effect**
B or b	**Span**
H / B	**Height to Span Ratio**
B^2 / S	**Geometric Aspect Ratio**
X_p	**Centre of Pressure**
e	**Span efficiency**
AR	**Aspect Ratio**
AOA	**Angle of Attack**