

STUDI NUMERIK PERBANDINGAN KARAKTERISTIK AIRFOIL NACA 4412 DAN NACA 4415 MEMPERTIMBANGKAN GROUND EFFECT TERHADAP VARIASI SUDUT SERANG

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Abstrak

Wing-in-ground (WIG) *craft* merupakan jenis pesawat yang memiliki mekanisme terbang rendah dengan memanfaatkan *ground effect* sehingga meningkatkan performa aerodinamikanya. Fenomena *ground effect* terhadap karakteristik aerodinamika merupakan fungsi dari ketinggian. Untuk mengetahui performa aerodinamika pada WIG *craft*, kajian numerik pada airfoil NACA 4412 dan 4415 dilakukan dengan pendekatan *Reynolds-Averaged Navier-Stokes* (RANS) *incompressible* pada kecepatan 28 m/s. Pada penelitian ini, kajian dilakukan dengan *domain* 2D dan model turbulen *Spalart-Allmaras* (S-A). Dari hasil simulasi didapatkan karakteristik aerodinamika NACA 4412 dengan nilai C_l tertinggi pada sudut serang 9° dan C_d terendah pada sudut serang 3° . Adapun performa aerodinamika yang direpresentasikan dengan C_l/C_d didapatkan nilai tertinggi sebesar pada ketinggian dan sudut serang.

Hasil perbandingan *airfoil* menunjukkan hasil terbaik CFD pada dua model 2D terjadi pada saat ketinggian $0,1c$ dan sudut serang 3° dan 6° dengan nilai $C_l/C_d = 115,1604$. Nilai koefisien lift untuk NACA 4415 lebih tinggi dibandingkan NACA 4412. Untuk koefisien *drag* pada NACA 4415 cenderung mengalami kenaikan sedangkan pada NACA 4412 koefisien drag mengalami penurunan karena adanya perbedaan ketebalan *camber* dan kerapatan *meshing*. Karakteristik dari kedua *airfoil* ini tidak begitu berbeda di mana koefisien lift berada di nilai maksimum pada sudut serang 9° , 12° , dan 15° , sedangkan untuk koefisien *drag* akan mengalami peningkatan seiring bertambahnya sudut serang sehingga bisa mengalami *stall* atau terjadi penurunan performa.

Kata kunci: WIG, *ground effect*, CFD, koefisien lift, koefisien *drag*

NUMERICAL STUDY OF THE COMPARISON AT NACA 4412 AND NACA 4415 AIRFOIL CHARACTERISTICS CONSIDERING THE GROUND EFFECT ON THE ANGLE OF ATTACK VARIATIONS

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Abstract

Wing-in-ground (WIG) craft is a type of aircraft that has a low-flying mechanism by utilizing the ground effect to improve its aerodynamic performance. The phenomenon of the ground effect on aerodynamic characteristics is a function of altitude. A numerical study on the NACA 4412 and 4415 airfoils was carried out using the Reynolds-Averaged Navier-Stokes (RANS) incompressible approach at a velocity of 28 m/s. In this study, the study was conducted using a 2D domain and the Spalart-Allmaras (S-A) turbulence model. From the simulation results obtained aerodynamic characteristics of NACA 4412 with the highest C_l value at the angle of attack 9° and the lowest C_d at the angle of attack of 3° . As for the aerodynamic performance represented by C_l/C_d , the highest value was obtained at the height and angle of attack.

The airfoil comparison results showed the best CFD results on two 2D airfoil models occurred at the altitude of $0.1c$ and angles of attack 3° and 6° with $C_l/C_d=115.1604$. The lift coefficient value for NACA 4415 was higher than NACA 4412. The drag coefficient for NACA 4415 tended to increase, while for NACA 4412 the drag coefficient decreased due to the differences in camber thickness and meshing density. The characteristics of the two airfoils were not so different where the lift coefficient was at its maximum value at angles of attack of 9° , 12° , and 15° , while the drag coefficient would increase with increase of angle of attack so that it could stall or decrease the performance.

Keywords: *WIG, ground effect, CFD, lift coefficient, drag coefficient*

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