ANALISIS KESTABILAN STATIK PESAWAT UDARA NIR AWAK (PUNA) UNTUK PEMANTAU KEPADATAN LALU LINTAS DENGAN MENGGUNAKAN SOFTWARE XFLR5

Agus Rohmanto
NIM. 16050084, Email: Sugarohmanto@gmail.com
Program Studi Teknik Dirgantara, Institut Teknologi Dirgantara Adisutjipto (ITDA)
Jl. Janti Blok -R Lanud Adisutjipto Yogyakarta

ABSTRAK

Salah satu pemanfaatan pesawat udara nir awak (PUNA) yaitu untuk misi pemantauan kepadatan lalu lintas. Namun dalam merancang PUNA penting untuk memperhatikan konfigurasi serta penempatan komponen pesawat, karena dapat berpengaruh terhadap kestabilan statiknya. Stabilitas statik adalah kecenderungan atau respon awal suatu sistem, ketika diganggu dari kondisi ekuilibrium. Pesawat yang stabil statik akan mampu menghasilkan momen untuk kembali ke kondisi tersebut. Sehingga dalam proses perancangan PUNA perlu dilakukan analisis terhadap kestabilan statik, sebelum masuk ketahap produksi.

Analisis menggunakan software XFLR5 untuk mengetahui performa kestabilan statik PUNA pada matra longitudinal dan lateral direksional. Pemodelan pesawat PUNA menggunakan software XFLR5 diinput data geometri dari perancangan berupa airfoil, wing, vertical tail, horizontal tail, serta fuselage. Hal-hal yang dianalisis adalah parameter-parameter aerodinamika seperti C_L, C_m, C_l, dan C_n yang terjadi dengan beberapa variasi sudut serang, sudut slip samping, dan horizontal tail incidence angle.

Berdasarkan analisis menggunakan software XFLR5 didapatkan hasil berupa paramater-parameter kestabilan statik yaitu C_{m_α}, C_{m_0}, C_{l_β}, dan C_{n_β}. Hasilnya, pesawat PUNA belum memenuhi seluruh kriteria kestabilan statik matra longitudinal ($C_{m_\alpha} < 0$ dan $C_{m_0} > 0$) karena nilai C_{m_α} = -0,0051 sedangkan nilai C_{m_0} = -0,0162. Namun pesawat PUNA telah memenuhi kriteria kestabilan statik matra lateral direksional ($C_{l_\beta} < 0$ dan $C_{n_\beta} > 0$) dengan nilai C_{l_β} = -0,0007 dan nilai C_{n_β} = 0,0043. Horizontal tail incidence angle (i_{HT}) berpengaruh terhadap kestabilan statik matra longitudinal dimana semakin positif sudut i_{HT} yang diberikan, maka semakin stabil statik pada matra longitudinal. Kebutuhan C_L pesawat PUNA pada kondisisi terbang jelajah dapat terpenuhi pada pengaturan minimal 2° i_{HT}, namun diperlukan kajian lebih lanjut dengan mempertimbangkan solusi-solusi lain yang lebih optimal.

Kata kunci: PUNA, Kestabilan Statik, XFLR5.

STATIC STABILITY ANALYSIS OF UNMANNED AERIAL VEHICLE (UAV) FOR TRAFFIC MONITORING USING XFLR5 SOFTWARE

Agus Rohmanto
NIM. 16050084, Email: Sugarohmanto@gmail.com
Program Studi Teknik Dirgantara, Institut Teknologi Dirgantara Adisutjipto (ITDA)
Jl. Janti Blok -R Lanud Adisutjipto Yogyakarta

ABSTRACT

One of the uses of unmanned aerial vehicle (UAV) is for traffic monitoring missions. However in designing UAV, it is important to pay attention to the configuration and placement of aircraft components, because they can affect its static stability. Static stability is the tendency or initial response of a system, when disturbed from an equilibrium condition. A statically stable aircraft will be able to generate a moment to return to that state. So that in the design process of UAV, it is necessary to analyze the static stability before entering the manufactur stage.

Analysis using XFLR5 software to determine the performance of static stability of UAV on the longitudinal and lateral directional dimensions. UAV modeling using XFLR5 software inputted geometric data from the design in the form of airfoil, wing, vertical tail, horizontal tail, and fuselage. The things that are analyzed are aerodynamic parameters such as C_L, C_m, C_l, and C_n which occur with several variations of angle of attack, side slip angle, and horizontal tail incidence angle.

Based on the analysis using XFLR5 software, the results are in the form of static stability parameters, such as C_{m_α}, C_{m_0}, C_{l_β}, and C_{n_β}. As a result, the aircraft did not meet all the criteria for the longitudinal static stability ($C_{m_\alpha} < 0$ and $C_{m_0} > 0$) because the value of $C_{m_\alpha} = -0.0051$ while the value of $C_{m_0} = -0.0162$. However, the aircraft has met the criteria for lateral- directional static stability ($C_{l_\beta} < 0$ and $C_{n_\beta} > 0$) with a value of $C_{l_\beta} = -0.0007$ and a value of $C_{n_\beta} = 0.0043$. Horizontal tail incidence angle (i_{HT}) has an effect on the longitudinal static stability where the more positive the i_{HT} angle given, the more stable on the longitudinal static dimension. The C_L needs of aircraft in cruising flight conditions can be met at a minimum setting of 2° i_{HT}, but further studies are needed by considering other more optimal solutions.

Keywords: UAV, Static Stability, XFLR5.