INTISARI

Pesawat NC-XXXX merupakan pesawat bersayap tetap (*fixed-wing aircraft*) yang mengandalkan integritas struktural komponen kontrol seperti *fixed leading-edge slots* untuk menjaga kinerja aerodinamis, terutama pada fase *take-off* dan *landing*. Namun, ditemukan celah (*gap*) sebesar 3 mm antara *slot* dan *flap* akibat ketidaksesuaian dimensi, yang dapat mengganggu distribusi beban dan memicu kegagalan struktural. Untuk mengatasi masalah ini, dilakukan *re-design* ketebalan *fitting* penghubung dari 3 mm menjadi 6 mm. Penelitian ini bertujuan untuk menganalisis pengaruh *re-design* ketebalan *fitting* terhadap kekuatan struktural, khususnya dalam menahan beban geser, tarik, dan dukung, serta memvalidasi hasil perhitungan analitik dengan simulasi *Finite Element Analysis* (FEA). Metode penelitian meliputi perhitungan analitik beban aerodinamis dan struktural, analisis kegagalan struktural (*shear failure, tension failure*, dan *bearing failure*), serta simulasi FEA menggunakan perangkat lunak SolidWorks. Hasil penelitian menunjukkan bahwa *re-design* ketebalan *fitting* dari 3 mm menjadi 6 mm meningkatkan *margin of safety* (MS) secara signifikan pada semua mode kegagalan. Pada kondisi *landing*, MS untuk kegagalan tarik meningkat dari 2,5 (3 mm) menjadi 6 (6 mm), untuk kegagalan geser dari 0,5 (3 mm) menjadi 1,37 (6 mm), dan untuk kegagalan dukung dari 0,25 (3 mm) menjadi 1,2 (6 mm). Hasil simulasi FEA menunjukkan kesesuaian tinggi dengan perhitungan analitik, dengan kesalahan relatif (%Error) sebesar 0,4% untuk tegangan geser dan 1,1% untuk tegangan tarik. Kesimpulan penelitian ini adalah *fitting* hasil *re-design* ketebalan 6 mm dinyatakan aman digunakan karena memenuhi kriteria margin of safety (MS $\geq$ 0) sesuai standar FAR 25.305. Selain itu, solusi *re-design* ketebalan *fitting* lebih ekonomis dibandingkan dengan produksi ulang *flap* atau penggunaan material alternatif. Penelitian ini memberikan kontribusi dalam pengembangan metode analisis kekuatan struktural dan validasi menggunakan simulasi FEA, yang dapat diaplikasikan dalam berbagai bidang rekayasa.

Kata kunci: *Fitting, Gap, Slot*, Kekuatan Hasil *Re-design*

ABSTRACT

The NC-XXXX aircraft is a fixed-wing aircraft that relies on the structural integrity of control components such as fixed leading-edge slots to maintain aerodynamic performance, especially during the take-off and landing phases. However, a 3 mm gap between the slot and flap was discovered due to dimensional discrepancies, which could disrupt load distribution and lead to structural failure. To address this issue, a re-design of the connecting fitting thickness from 3 mm to 6 mm was implemented. This study aims to analyze the effect of the re-design on the structural strength of the fitting, particularly in resisting shear, tension, and bearing loads, as well as to validate analytical calculations with Finite Element Analysis (FEA) simulations. The research methodology includes analytical calculations of aerodynamic and structural loads, analysis of structural failure modes (shear failure, tension failure, and bearing failure), and FEA simulations using SolidWorks software. The results show that the re-design of the fitting thickness from 3 mm to 6 mm significantly increases the margin of safety (MS) for all failure modes. Under landing conditions, the MS for tension failure increased from 2.5 (3 mm) to 6 (6 mm), for shear failure from 0.5 (3 mm) to 1.37 (6 mm), and for bearing failure from 0.25 (3 mm) to 1.2 (6 mm). The FEA simulation results showed high consistency with analytical calculations, with relative errors (%Error) of 0.4% for shear stress and 1.1% for tensile stress. The study concludes that the re-designed 6 mm thick fitting is safe for use as it meets the margin of safety ($MS \geq 0$) criteria according to FAR 25.305 standards. Additionally, the re-design of the fitting thickness is more economical compared to reproducing the flap or using alternative materials. This research contributes to the development of structural strength analysis methods and validation using FEA, which can be applied in various engineering fields.

Keywords: *Fitting, Gap, Slot, Strenght Result of Re-design*