CHAPTER I
INTRODUCTION

1.1 Background

The winglet is a device that reduces the induced drag of the aircraft and saves fuel. Since the beginning of the 2000s, aircraft designers have been using extra 'parts' on the wing ends. These small extensions usually referred to as winglets, are intended to increase the aircraft's performance by reducing drag. These unusual wingtips have aerodynamic advantages that come from nature; many birds, especially gliding birds, curl up their wings at the ends to improve their flight efficiency.

How do winglets work? The purpose of winglets use in aircraft is to reduce turbulence at the top wings, and also Reduces vortex drag (induced drag), which is exceptionally high during takeoff and landing. Whirlpools steal energy from plane movement, so wingtips in theory reduce fuel consumption by reducing drag. To put it simply, during the takeoff and landing of a plane, the high-pressure air converts the wingtip into low-pressure air, forming the wingtip vortex. This drag occurs because the pressure of the wingtip vortex is lower than the pressure of the air passing over the wing.

In the last decade, winglets have become more popular, with aircraft manufacturers installing them not only to reduce drag but also because they can improve fuel efficiency by up to 5%. In fact, on modern jets today, winglets of any type or form are pretty much standard equipment, and some airlines are also upgrading them to older aircraft. Notice that all winglets are the same because their function is the same. A West Jet Boeing 737 800 with branded winglets.

In aerodynamic engineering, drag reduction is a big challenge. To reduce the drag a device called a winglet is placed vertically at a set of angles on the end of the aircraft wing (Khamis and Rameshkumar, 2016). The winglet is played a very important role in improving aircraft performance. Aircraft designers are performing research to improve aircraft efficiency which will be a benefit to both

aircraft manufacturers and operators. Several different types of winglet devices have been developed to improve efficiency and the selection of the winglet device depends on the specific situation and the aircraft type.

1.2 The limitation of the problem

- The phenomena of the winglet in aircraft fight
- NACA 2313 airfoil used in this project compared to NACA 2312
- The simulation of the raked winglet done using xflr5 and Catia tutorial.
- Investigating the drug and the left force on the wing
- The batch airfoil analysis is done in 150.000 Re subjected to winds velocity at 30 m / s.
- Maximum angle of attack set 10^{o}

1.3 The phenomena of the winglet

wings are an aircraft's most critical framework in aircraft affects in all flight phases, like stall speed, cruise speed, handling behavior (particularly near the stall), take-off, landing distances, and overall aerodynamic efficiency.

Lift is created when the upper wing surface has a lower pressure, and the lower wing surface has a higher pressure. This impact would cause the flow from the lower pressure zone to the high pressures zone at the wingtip for a wing of finite duration. The cross-flow at the wing tip meets at the edge of the trailing which creates a vortex of wingtips.

The energy in the vortex is extracted from the movement through the wing, thus the energy loss decreases the wing's total lifting power. The lost energy is called induced drag. If a plane with an infinite aspect ratio exists, the air passes over the surface of the wing without any inward or outward deflection, and thus no wing-tip vortices, no induced drag. Yet, in realistic flight, such a thing is not feasible. An increase in duration will change the root bending automatically moment in effect having more structural mass.

The winglet device is the extent at the tip of the wing, which is positioned at every angle to the existing wing surface to slow down the development of rotating vortex flow at the tip of the wing.

1.4 Aims

When I started this project, I would have good knowledge about most of the applications uses for this type of task, but after a long time of the study, I learned a lot. Winglets are used

1. Essentially this project aims to investigate the lift to drag characteristics in NACA 2313 and NACA 2312.
2. Compare between to NACA four digits airfoil.
3. Investigating the drug and the left force on the winglet.
4. Ascertaining the best performance of airfoil in terms of Cl/Cd for winglet

1.5 Objectives

1. Modify airfoil to compare the efficiency between the difference of NACAs and simulate in xflr5 application.
2. Later, an evaluation of the results of this project will be discovered, and the high efficiency of the airfoil in terms of Cl / Cd will be investigated.
3. The differences between NACA 2312 and NACA 2313 will be discovered.
4. The result of simulations will be analyzed and compared with the finding observed airfoil model with the wing.