Introduction

UAVs are robotic aircraft systems that function autonomously or are remotely piloted. There are various applications of UAVs in different fields, a simple example is in civil security work. In most of the applications their main role is monitoring and close observation of the object and terrain they fly over. One of which is; monitoring above ground oil and gas pipelines for maintenance purposes.

![Fig 1: Fixed-wing UAV following a Pipeline](image1)

Flight control System

A Proportional-Integral-Derivative (PID) controller was used to design the flight control system using Ziegler-Nichols’s tuning method. The PID was used to control the heading maneuver of the UAV. **Fig 2** below illustrates the feedback flight control system.

![Fig 2: Flight Control System](image2)

The feedback calculates the heading error as the difference between the UAV’s desired heading, $\psi_d$, and the measured angle, $\psi$. This error was fed into the controller and minimised by the use of the PID gains. Table 1 shows the gains used to obtain a robust heading controller.

<table>
<thead>
<tr>
<th>Kp</th>
<th>Kd</th>
<th>Ki</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>12</td>
<td>0.0012</td>
</tr>
</tbody>
</table>

**Table 1: Table of gains**

![Fig 3: Closed-loop Heading and Rudder response](image3)

Conclusion

In conclusion, the use of PID control method has been shown to provide robust flight performance of the UAV. Waypoint acquisition using LOS guidance shows that the scheme is robust.

Reference