EAST WEST UNIVERSITY

## Department of EEE

**Section:** 1

**Course Code:** EEE305

**Course Title:** Electromagnetic Fields and Wave

# Project(Task 03)

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**Submission Date:** 15/01/2023


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**Theory**

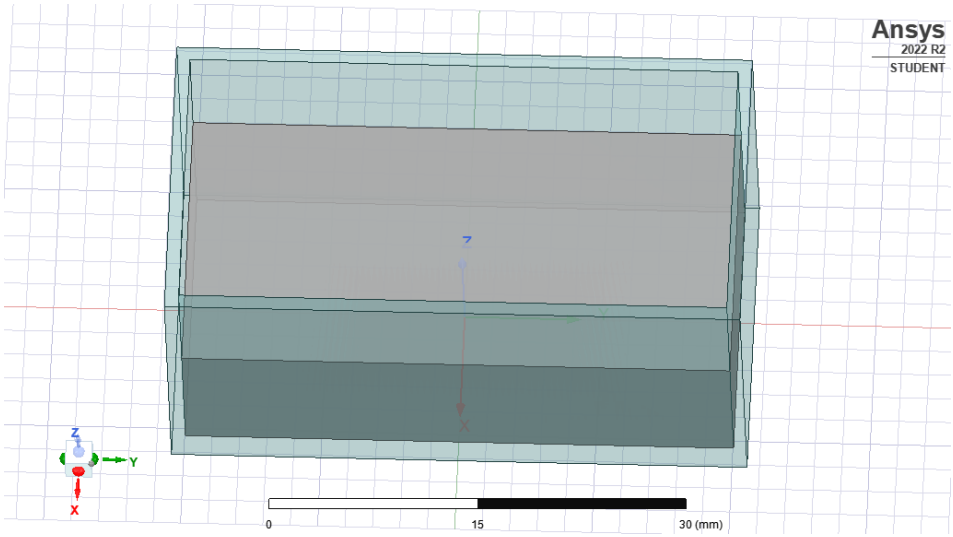
A capacitive fuel level sensor works by the principle of changing the capacitance due to the change of the height of the fuel in between the electrodes of the capacitor, as it is immersed into the fuel (left figure).

However, if the fuel level changes due to the tilting of the fuel tank (as is the case for an aircraft, where the aircraft leans during cruise or take-off or landing), the level sensor may give incorrect result (right figure).

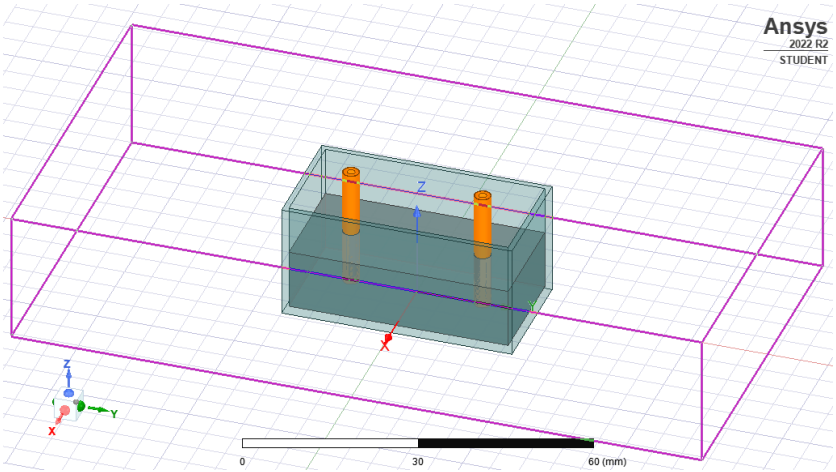

This can be solved by placing multiple capacitors in the fuel tank and measuring the total capacitance (equivalent capacitance of parallel capacitors). In this way, as the aircraft maneuvers, some probes are in more fuel than others, due to the change in fuel height. But the fuel level indication should remain steady, as the total capacitance of all the probes remains the same.

The design parameters are:
1. Inner radius of the cylindrical capacitors, a
2. Outer radius of the cylindrical capacitors, b
3. Distance between the capacitors, d

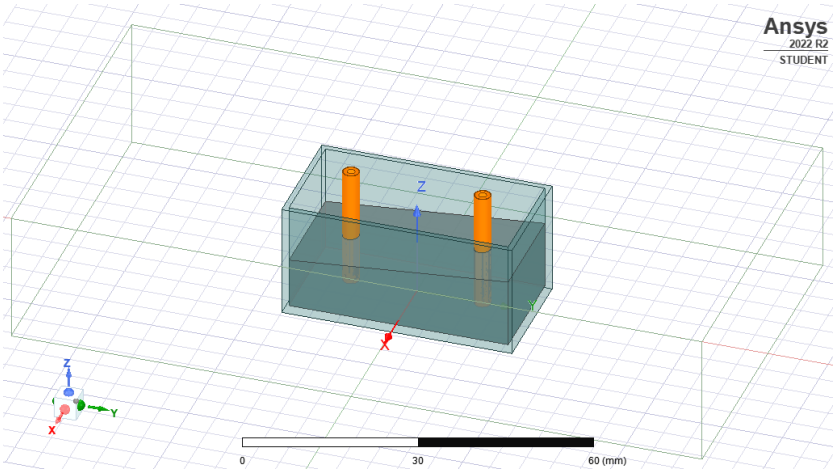
**Diagram:**



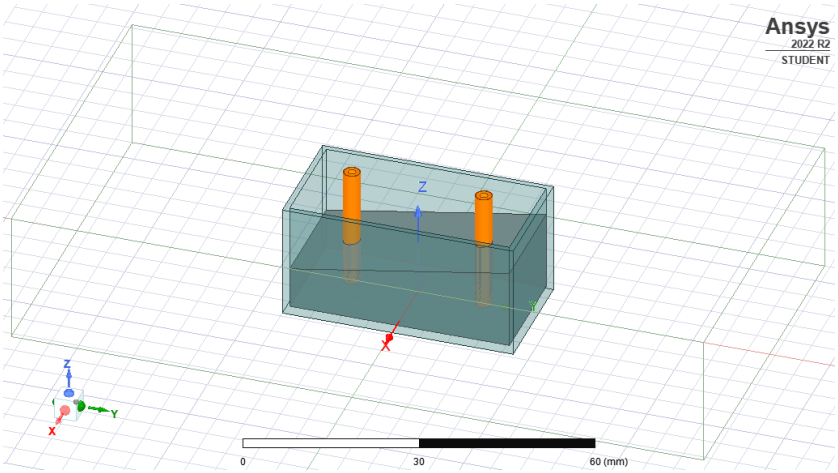
- When inclination angle is 0°



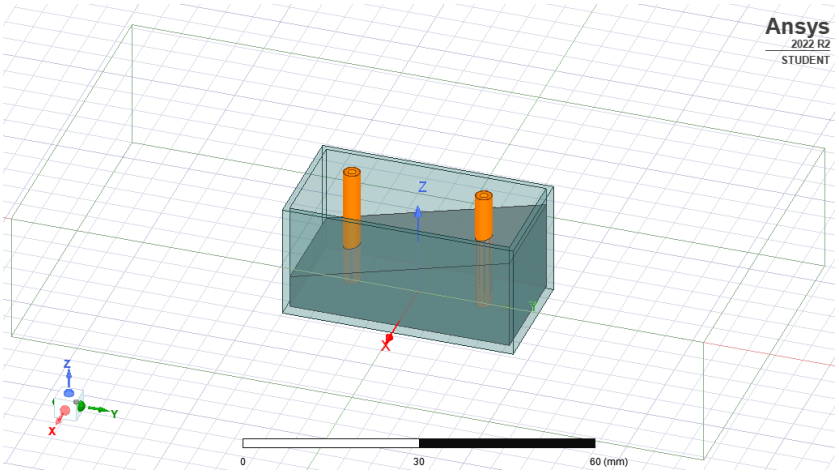

- When inclination angle is 5°



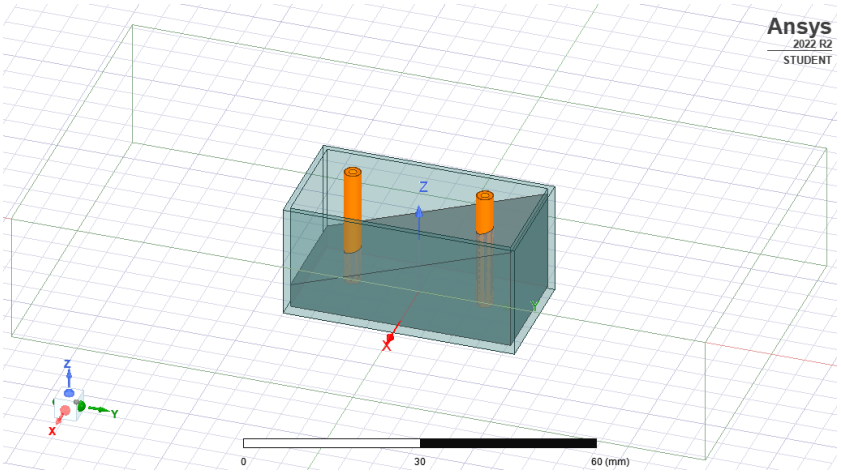

- When inclination angle is 10°



- When inclination angle is 15°

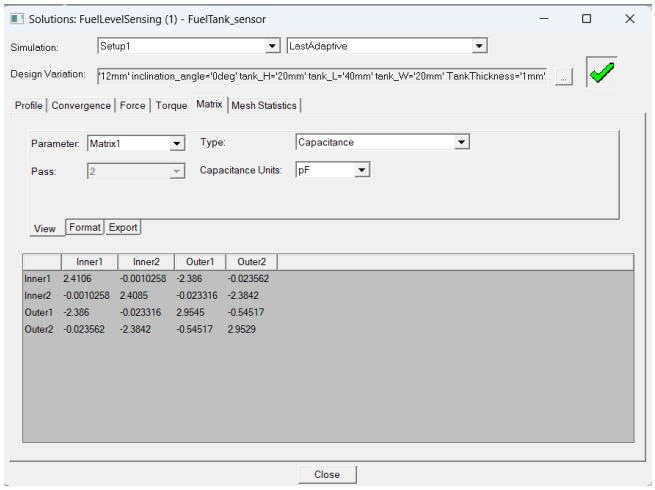



- When inclination angle is 20°

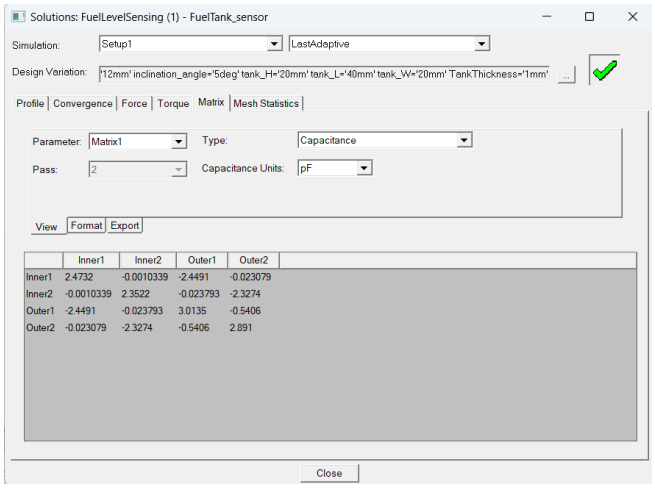



**Solution Data**

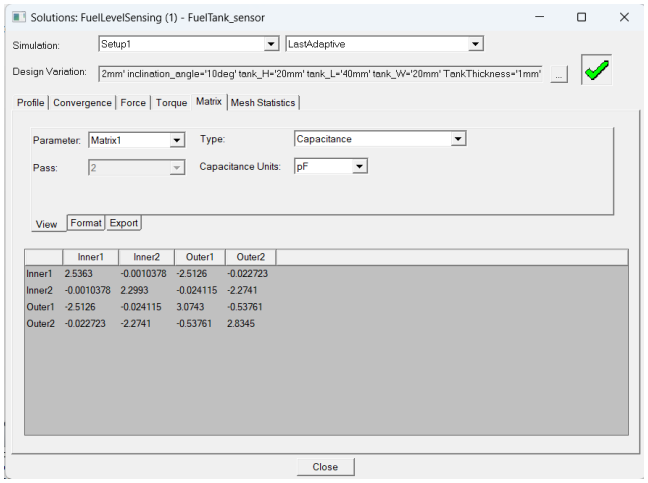
- When inclination angle is 0°



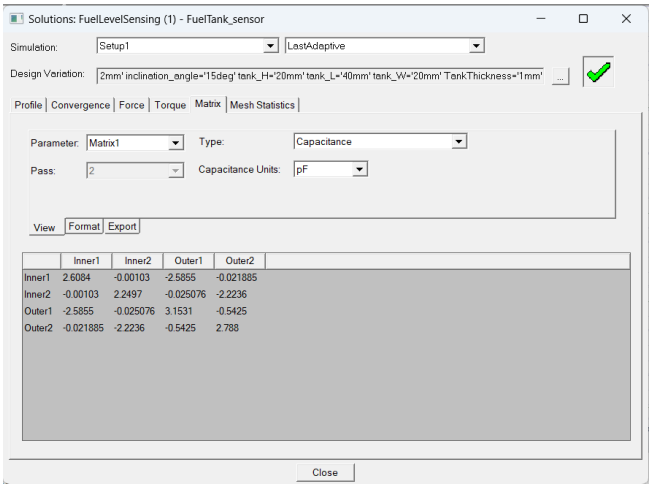
- When inclination angle is 5°




- When inclination angle is 10°




- When inclination angle is 15°



- When inclination angle is 20°

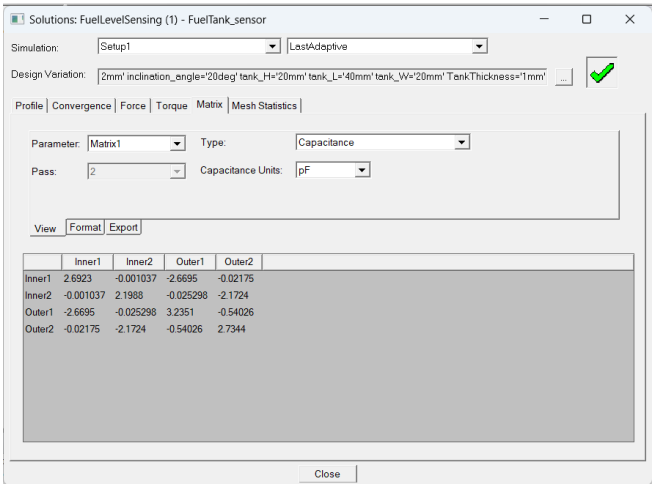



**Table:**

Table 01:

| Parameter | Value (mm) |
|---|---|
| Inner radius, a | 0.7 |
| Outer radius, b | 1.4 |
| Distance, d | 12 |

Table 02:

| Inclination angle | Capacitance of the first capacitor, C1 (pF) | Capacitance of the second capacitor, C2 (pF) | C1 + C2 (pF) |
|---|---|---|---|
| 0° | 2.386 | -2.3842 | 0.0018 |
| 5° | 2.4491 | -2.3274 | 0.1217 |
| 10° | 2.5126 | -2.2741 | 0.2385 |
| 15° | 2.5855 | -2.2236 | 0.3619 |
| 20° | 2.6695 | -2.1724 | 0.4971 |