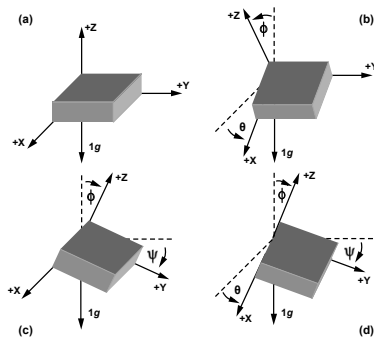# MBSD Assignment

Description

An anti-tilt sensing system shall be implemented using an accelerometer. The system is intended for being embedded in the cargo bay of heavy-duty vehicles, and it serves to warn about any odd distribution of the cargo.

Assuming the 3-axis accelerometer is placed as in the following figure, the inclination with respect to the 3 axes can be computed using the following equations.

$$\theta = \tan^{-1}\left(\frac{A_{X,OUT}}{\sqrt{A^2_{Y,OUT} + A^2_{Z,OUT}}} \right)$$

$$\psi = \tan^{-1}\left(\frac{A_{Y,OUT}}{\sqrt{A^2_{X,OUT} + A^2_{Z,OUT}}} \right)$$

$$\phi = \tan^{-1}\left(\frac{\sqrt{A^2_{X,OUT} + A^2_{Y,OUT}}}{A_{Z,OUT}} \right)$$

Every 100 msec, the embedded system reads the (A_X, A_Y, A_Z) triplets in g (range +/-2g) and it computes the inclinations angles. A warning indication shall be produced if any of the following condition is met:

- The inclination angle with respect to X, Θ is greater than +/-15 degrees;
- The inclination angle with respect to Y, Ψ is greater than +/-15 degrees;
- The inclination angle with respect to Z, Φ is greater than +/-15 degrees.

Requirements

1. You shall implement the embedded system using the FRDM K64F board, where the FXOS8700CQ is used as accelerometer, and the RGB LED is used as status indicator as follows:
   - In case of no warning, the GREEN LED is on and the others are off;
   - In case of warning, the RED LED is on and the others are off;
   - BLUE LED shall be turned on for the duration of the calibration phase, if needed.

   The LED colors are updated every 100 msec, after an initial calibration phase (if needed) that shall last no more than 1 minute;
2. The Simulink model shall be organized in three units, one managing the acquisition of the raw data from the accelerometer, one devoted to processing and output computation, and one for the control of the LEDs;
3. A test harness shall be provided for functional testing of the unit devoted to processing and output computation, which shall provide suitable test stimuli.

Rules

- The assignment is individual, and it shall be developed and delivered individually.
- You can discuss with your colleagues, but then the work you submit shall be original work from you.
- Assignment shall be submitted through portale della didattica as a single Simulink file by **June 12th, 2020 at 24:00**.