

Assignment on CPS Verification

Q. Consider a false data injection attack of length 3 on control signal is taking place from 1st iteration on the given system specification. Using CBMC verify a residue based detector's capability to detect such an attack attempt where ∞ -norm of the residue is compared with a threshold value of a) 0.05 and b) 0.1. If CBMC returns any attack, plot the following in Matlab to see system's response: i) system state and safety bound vs samples, ii) ∞ -norm of the residue and threshold vs samples.

States: phase angle (Θ) and frequency deviation (ω)

Control input: normalized mechanical power

System matrices:

$$A = \begin{bmatrix} 0.66 & 0.53 \\ -0.53 & 0.13 \end{bmatrix} \quad B = \begin{bmatrix} 0.34 \\ 0.53 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Controller gain: $K = [0.0556 \ 0.3306]$

Observer gain: $L = \begin{bmatrix} 0.36 & 0.27 \\ -0.31 & 0.08 \end{bmatrix}$

Initial region: for Θ $[-0.01, 0.01]$ and for ω $[-0.005, 0.005]$

Safety boundary: Θ should be within $[-0.1, 0.1]$ and ω should be within $[-0.05, 0.05]$

Detector: ∞ -norm of the residue should be within a) 0.05 and b) 0.1 (i.e. the threshold is 0.05 and 0.1)