# PROJECT OVERVIEW

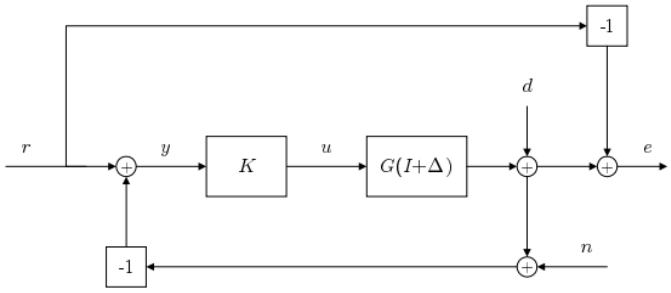
The main objective of the project is stability and robustness analysis of dynamically unstable nonlinear system (MIMO System having 10 states, 3 input and 10 output) similar to inverted pendulum having uncertainty in the plant and external disturbance.

**PROBLEMS:**

- Time varying & Non-linear Uncertainties in the Plant
  $G_\Delta = G + W1\Delta W2$

(W1 and W2 are real rational weighting matrices & Δ is full block or unstructured dynamic Uncertainties)

- Nonlinear external disturbances
- Noise from Sensors




**SOLUTION**

- Design a robustly stabilizing non-linear controller (H infinity) for all type of uncertainties in the plant and external disturbances (Only use frequency based technique which is H infinity control) and perform stability/robustness analysis (comparisons in terms of matlab graphs) for required system in MATLAB only.

- **MATERIAL WILL BE PROVIDED**

  - Only Mathematica file will be provided having mathematical model of the nonlinear system.
  - Documents (pdf format) related to optimal & robust control (H2 & H infinity) will be provided.

- **TIME LIMIT**
  - Maximum 15 to 20 days

- **TERMS & CONDITIONS**
  - Provide complete steps/plan (percentage wise) of the task within two days positively.
  - Report/progress must be shared regularly after 3 days (Monday & Thursday) along with code.
  - Provide brief document report of process & coding along with relevant/necessary materials.
  - Al least 10 to 15 output graphs for stability & robust analysis (Only Matlab Graphs)
  - Accurate result and simulation of stability & robust analysis of desired system.

**Proposed incomplete steps are given for information only and these steps may be changeable according to your plan.**

1. Calculate Transfer Matrix M
2. Small Gain Theorem for Robust Stability Analysis
3. Full block uncertainties Test
4. SSV Test (Structured Singular Value) for Lower & Upper Bound of frequencies
5. H (infinity) norms for Stable Transfer Matrix
6. Design H (infinity) controller and perform robustly stable & performance analysis of system