

UNIVERSITY OF
NEWCASTLE



ACM Model in Control System

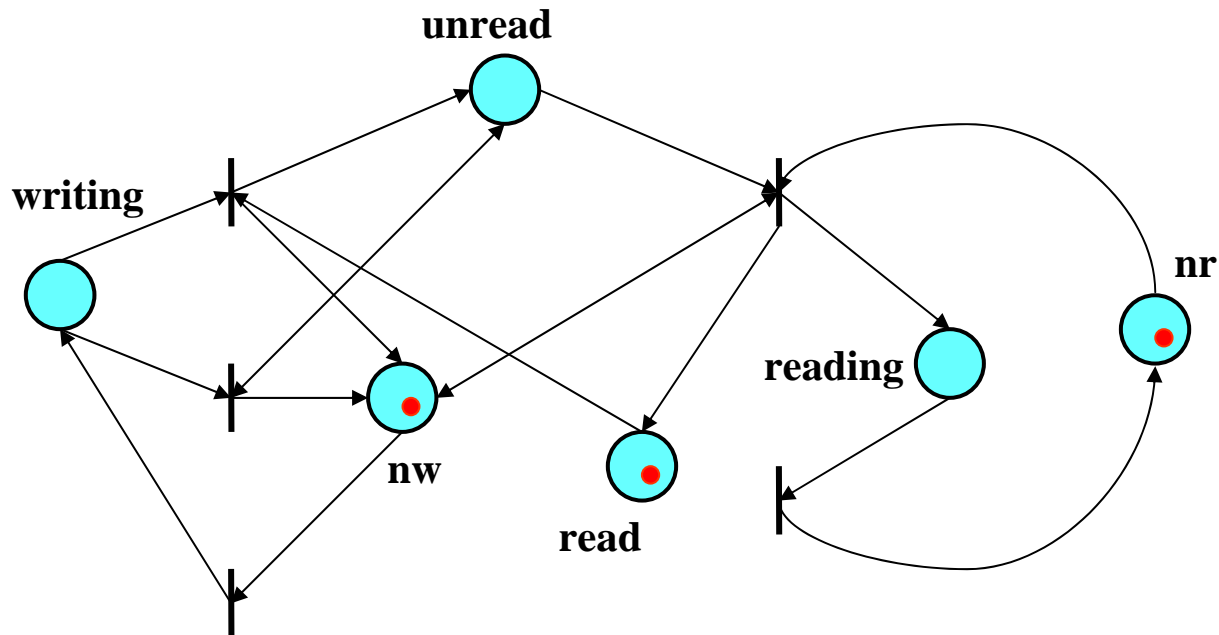
Coherent Meeting in
the University of Newcastle upon Tyne

Outline

- **Two ACM Models**
 - General Signal Model
 - RR-BB Algorithm Model (Message)
- **A Model of Broom Balancer**
- **Broom Balancer with ACM**
- **Conclusions and Future Works**

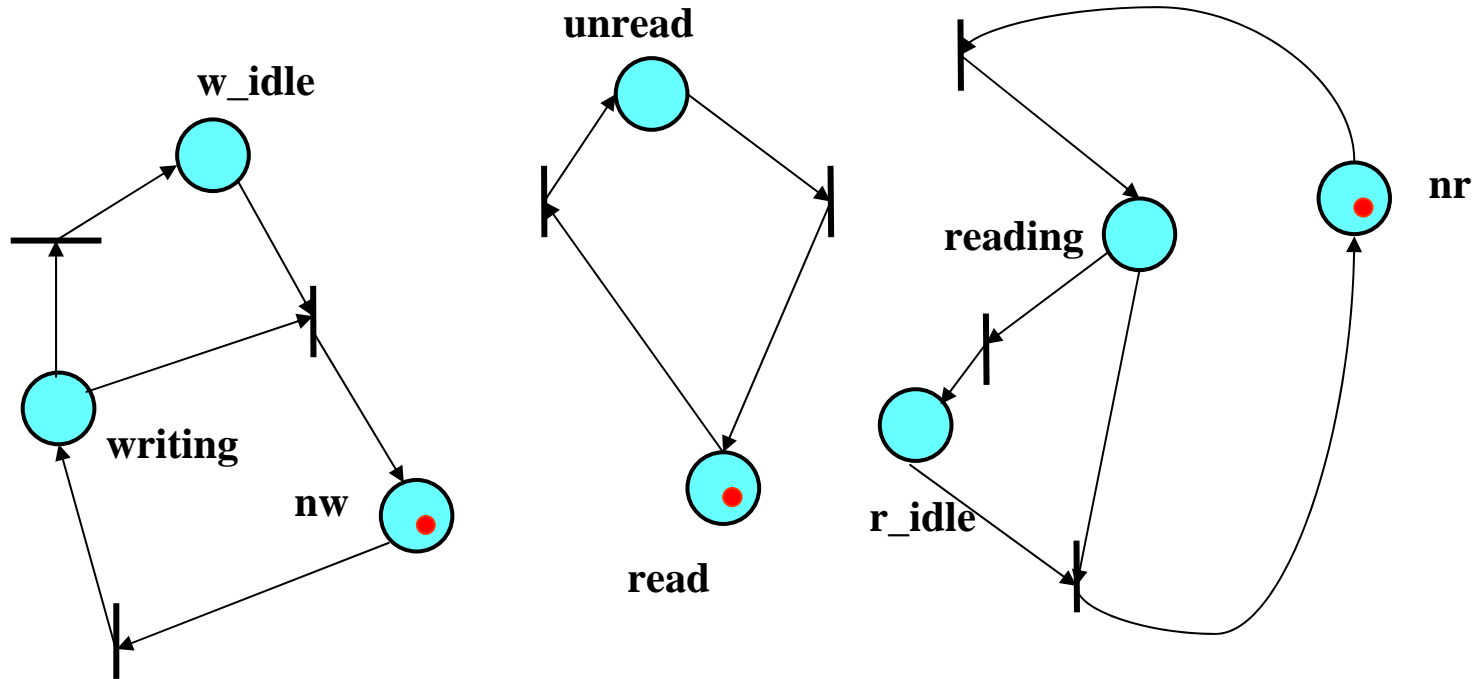
General Signal Model

- The Petri Net Model

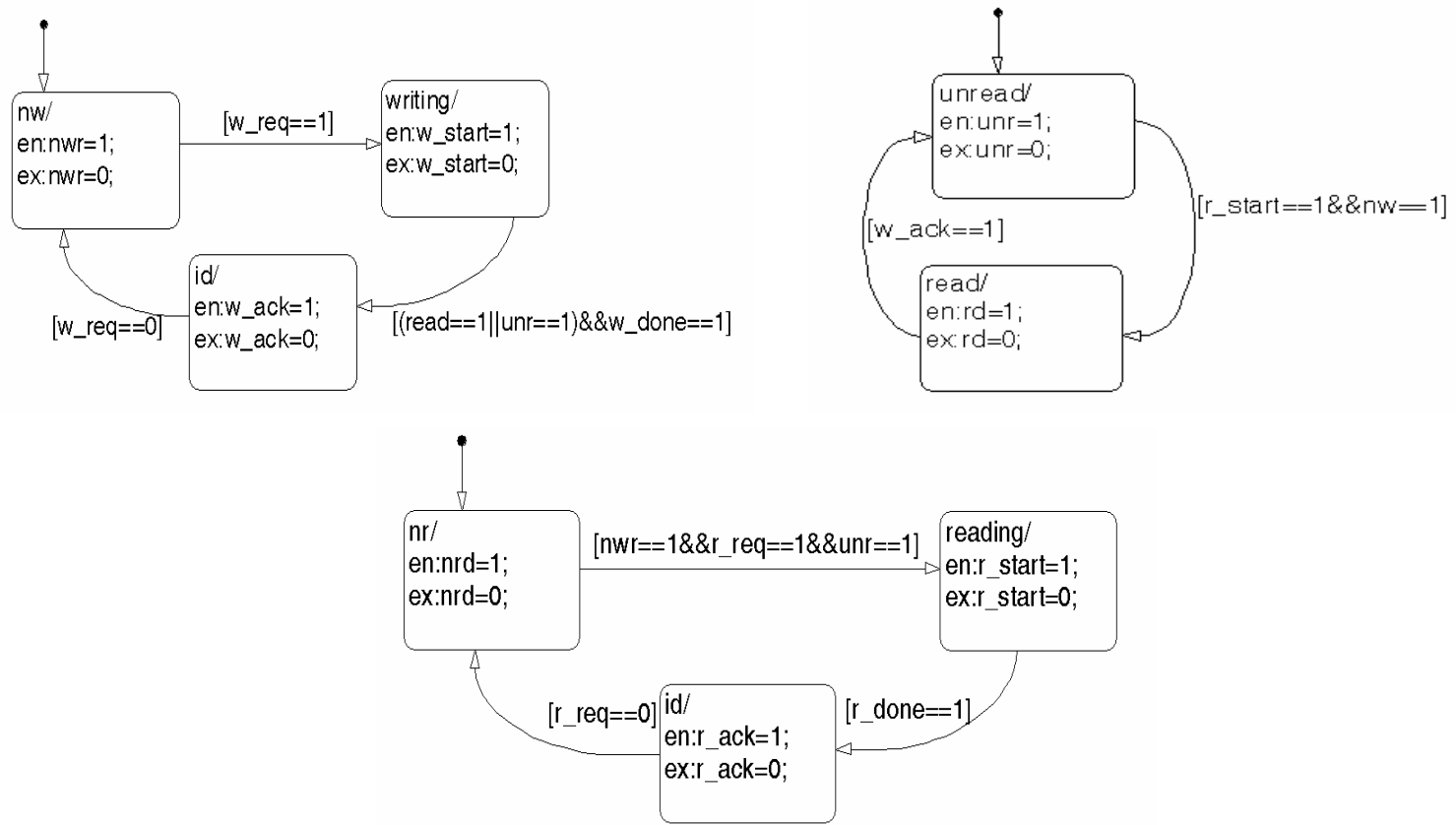


General Signal Model

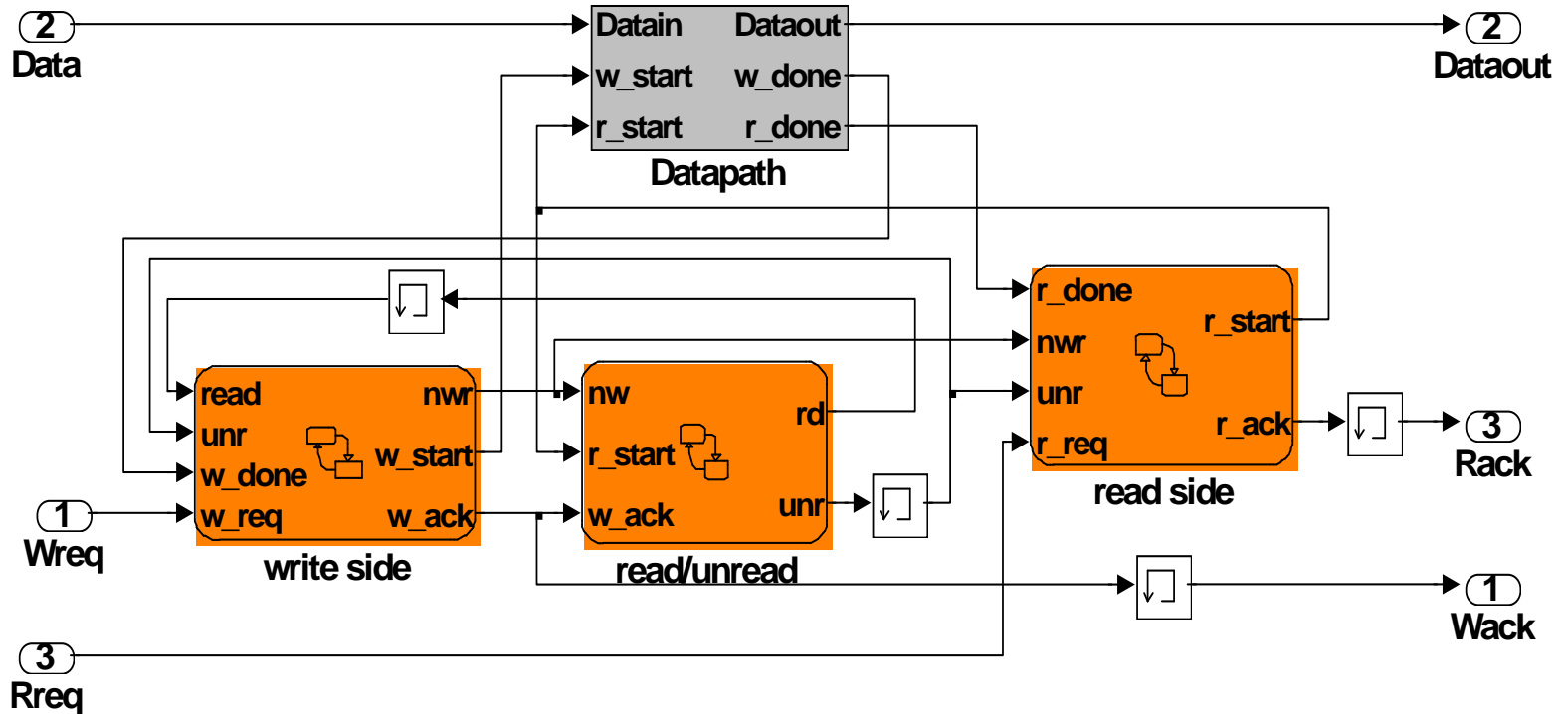
- Divide it into 3 parts



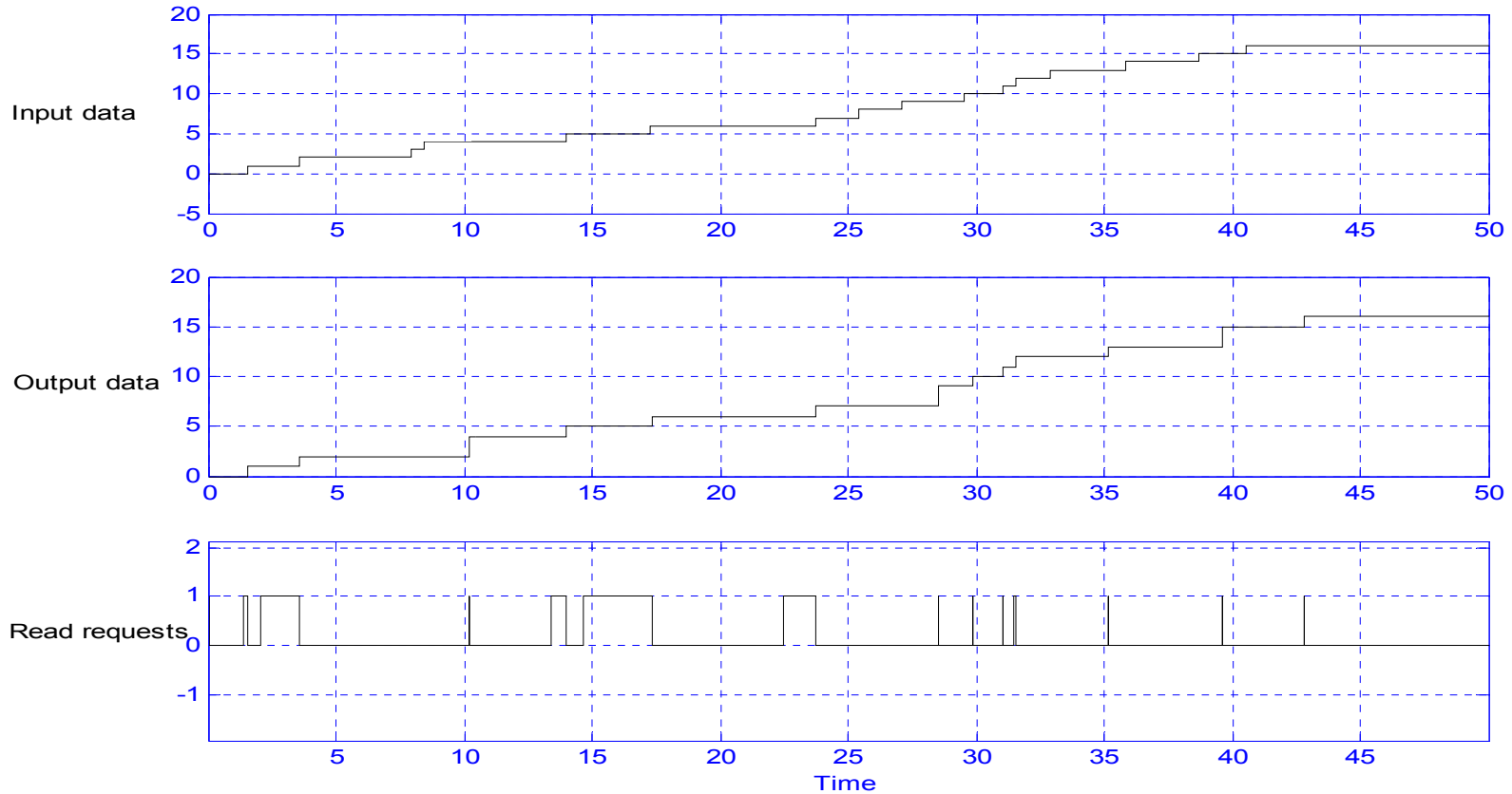
Stateflow Model



Model in Simulink



Simulation Results



RR-BB Algorithm

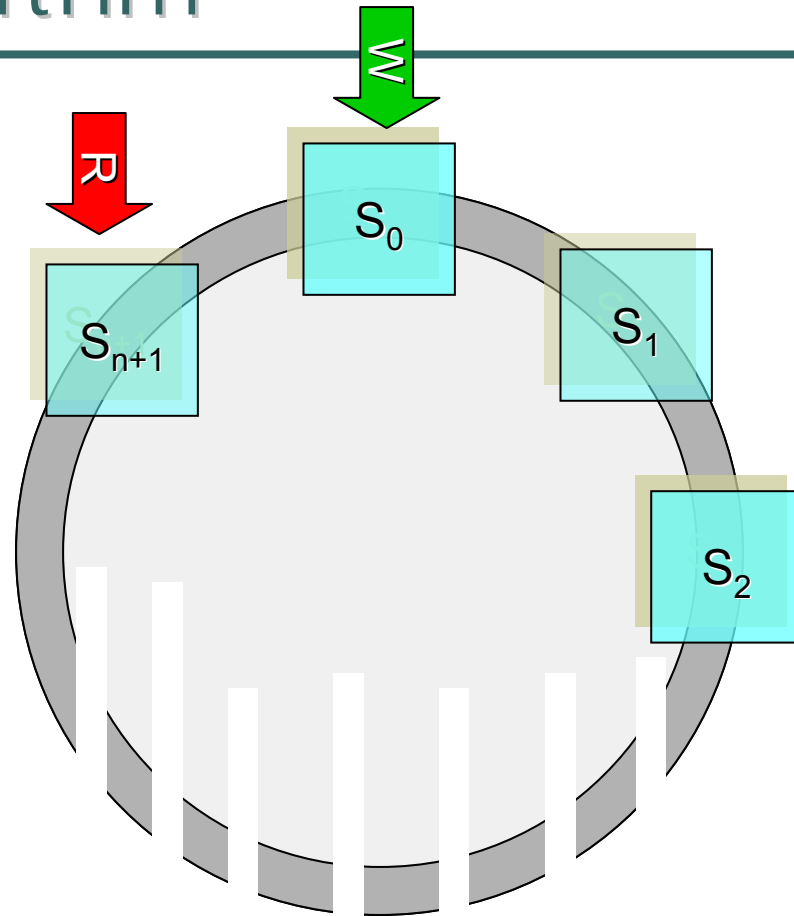
Global view

Re-reading

Writing

Reading

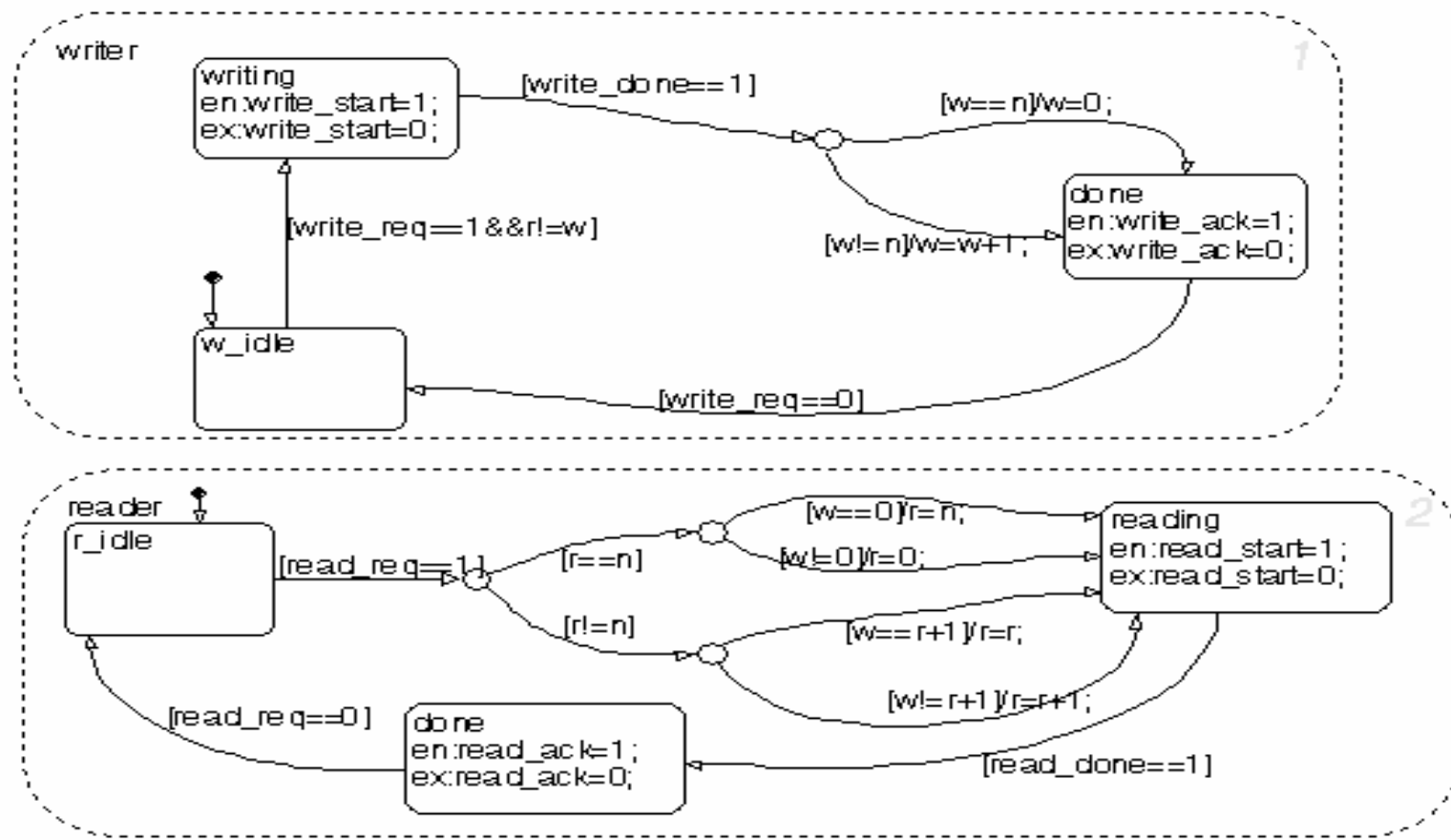
Writer waiting



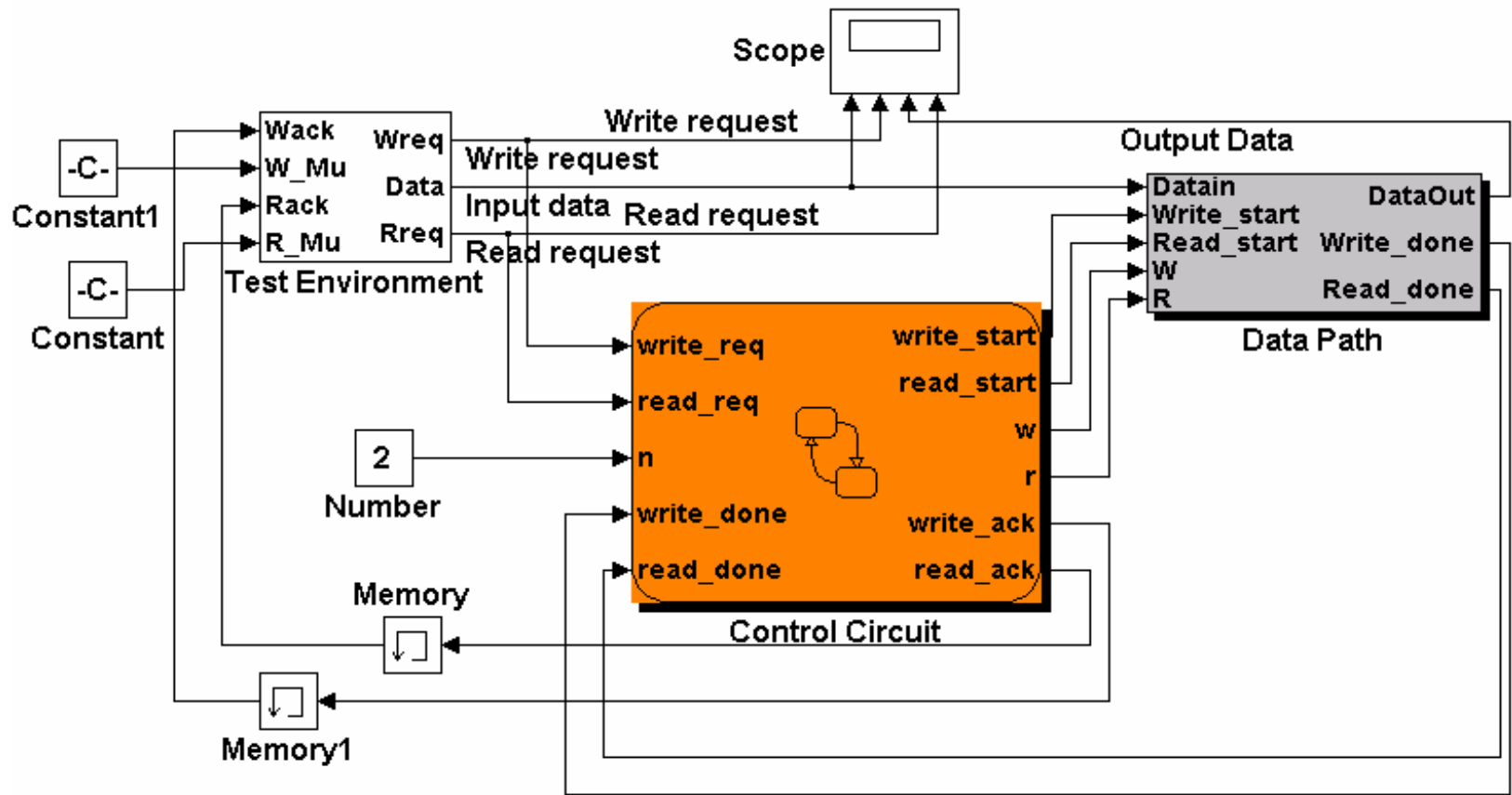
RR-BB Algorithm

- var w: 0...n+1; r: 0...n+1;
- **writer:**
wr: write w; w0: w:=(w+1 mod n+1); wait until r!=w;
- **reader:**
r0: if (r+1 mod n+1)!=w then r:=(r+1 mod n+1);
rd: read r;

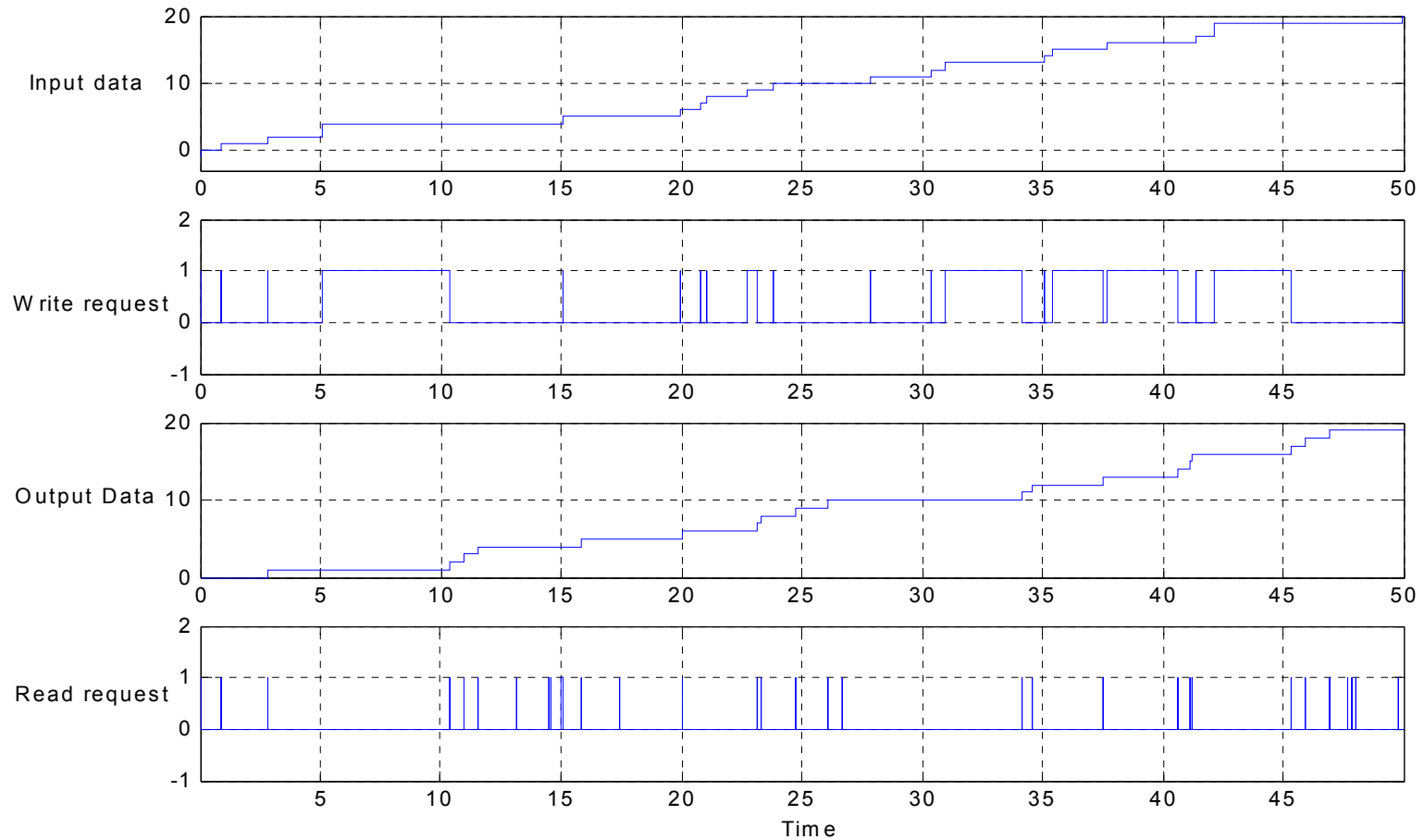
Stateflow Model



Model in Simulink



Simulation Results



2004-1-9

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RR-BB Algorithm

- Individual stage

- var w: 0..1 (writer pointer at this slot or not)
r: 0..1 (reader pointer at this slot or not)

- **writer:**

wr: write;

w0: w:=0; wnext:=1; wait until rnext:=0; advance;

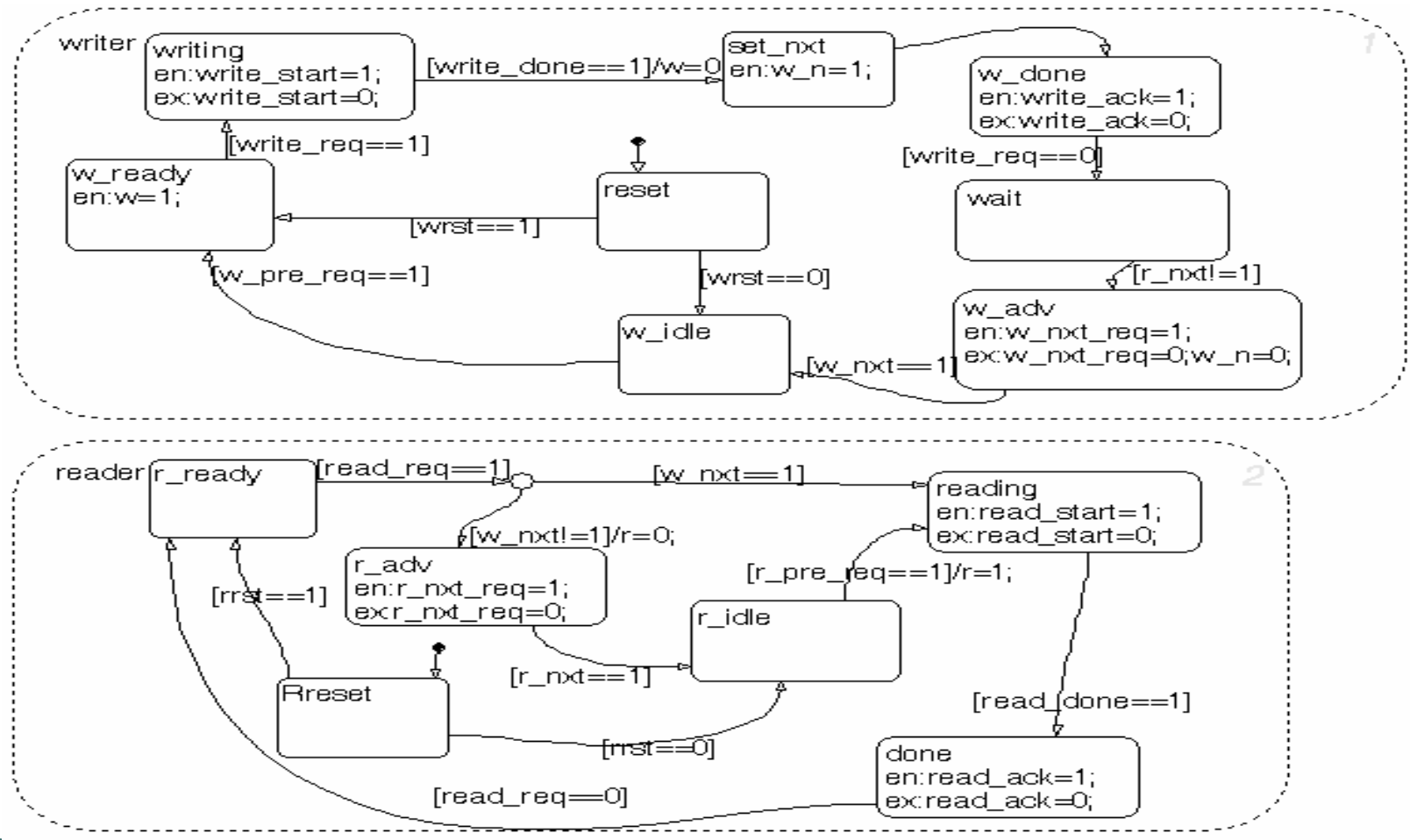
- **reader:**

r0: if wnext!=1 then

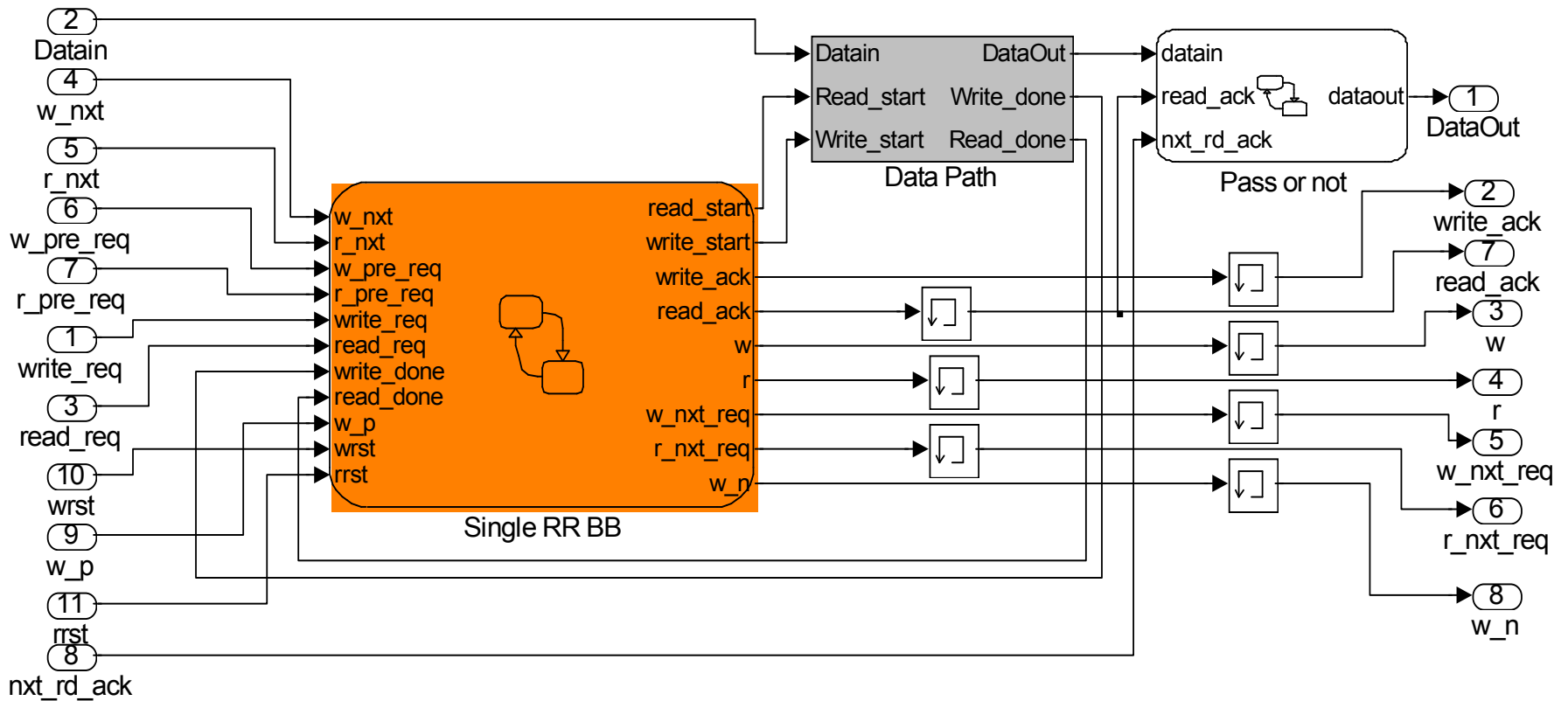
begin r:=0, rnext:=1, advance end;

rd: read;

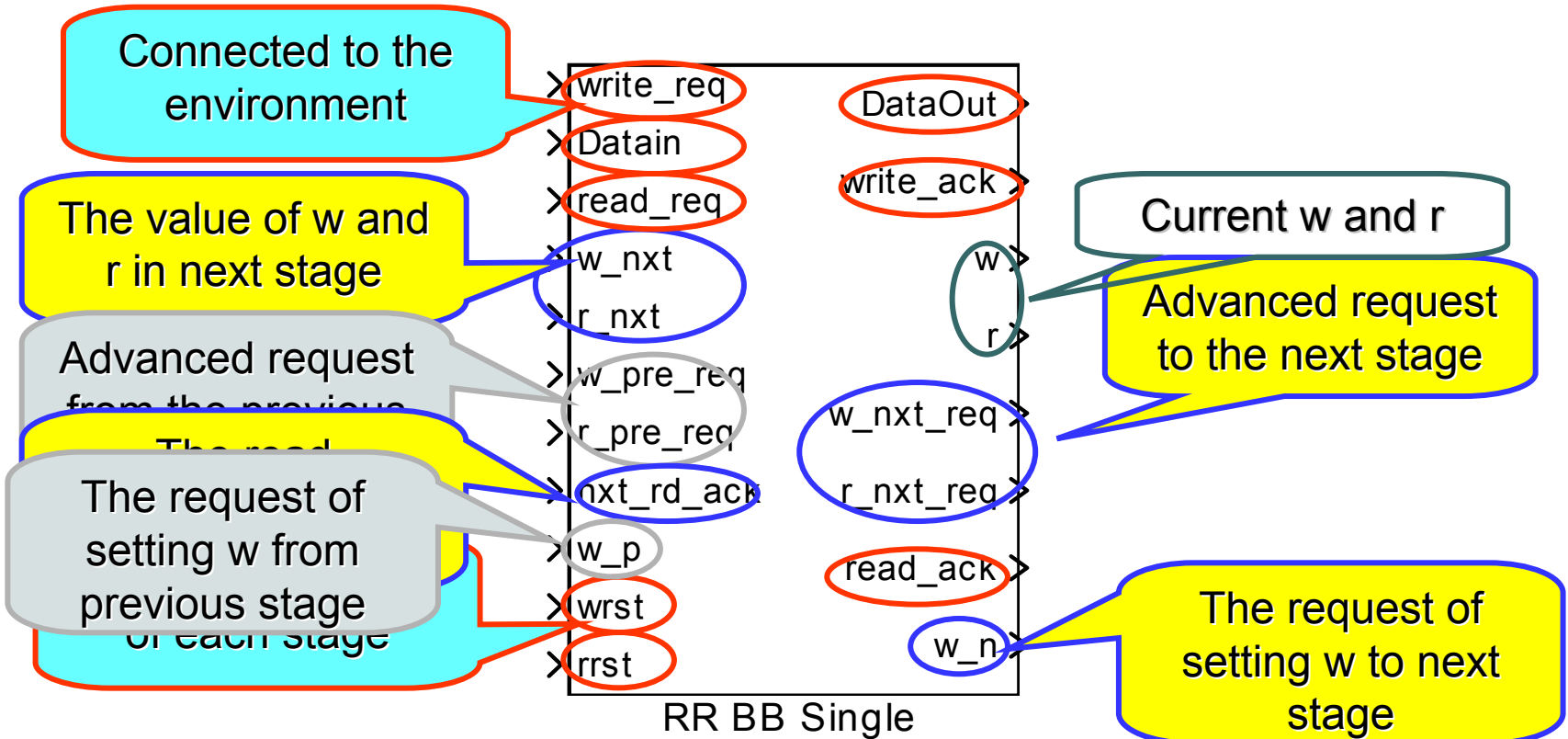
Stateflow Model



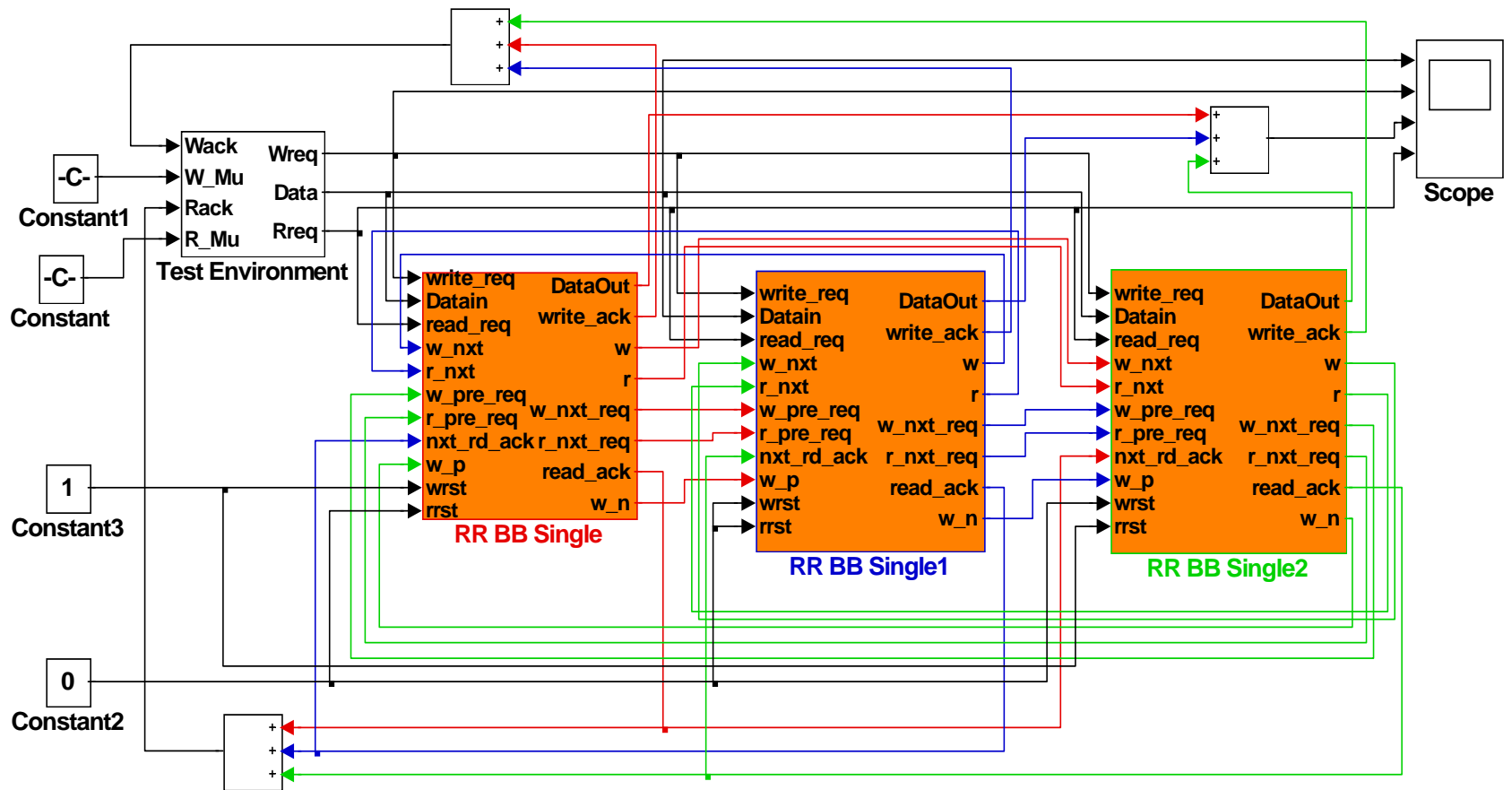
Single Stage



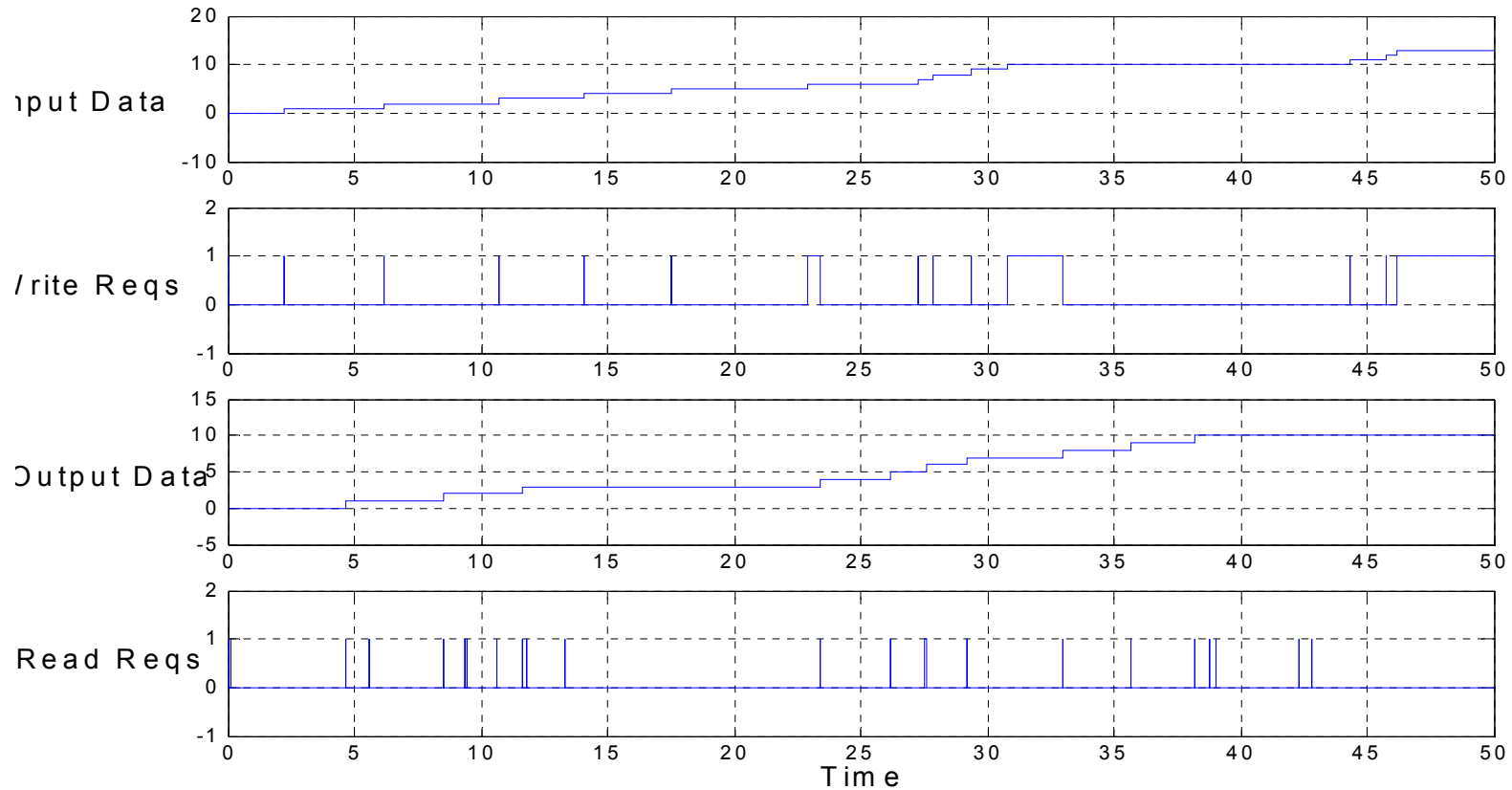
Single Stage



Model in Simulink

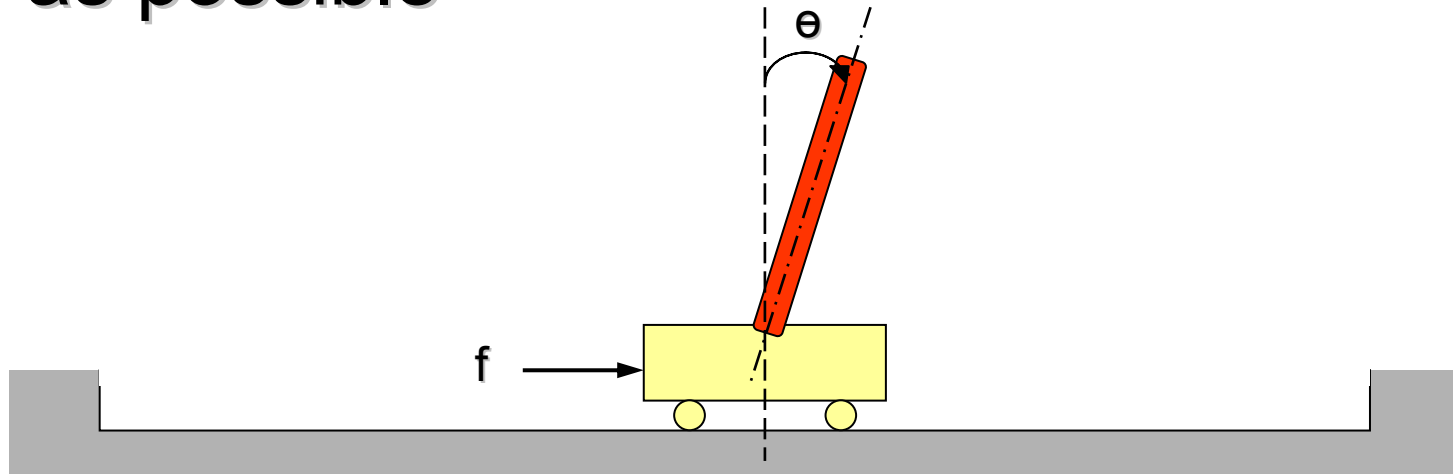


Simulation Results



Broom Balancer

- A trolley runs on a track and the broom handle is hinged to the trolley
- Aim: to keep the broom balanced as long as possible



Broom Balancer

- Broom and Trolley

$$x'' = \frac{F + M g \theta}{M}$$

$$\theta'' = \frac{\left[\frac{-F}{M} \right]}{l \left[\frac{4}{3} \right]}$$

- Approximated by a linear model

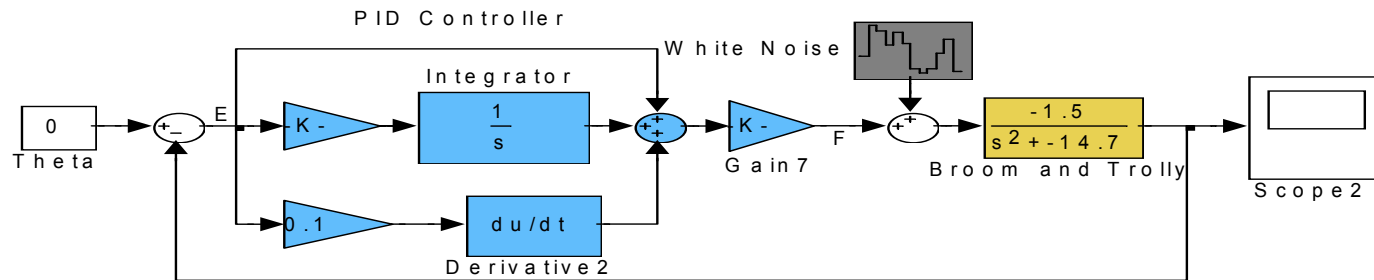
$$x'' = \frac{F}{M} \qquad \theta'' = \frac{3g\theta}{4l} - \frac{3F}{4Ml} = \frac{3}{4Ml} (Mg\theta - F)$$

Broom Balancer

- Broom and Trolley

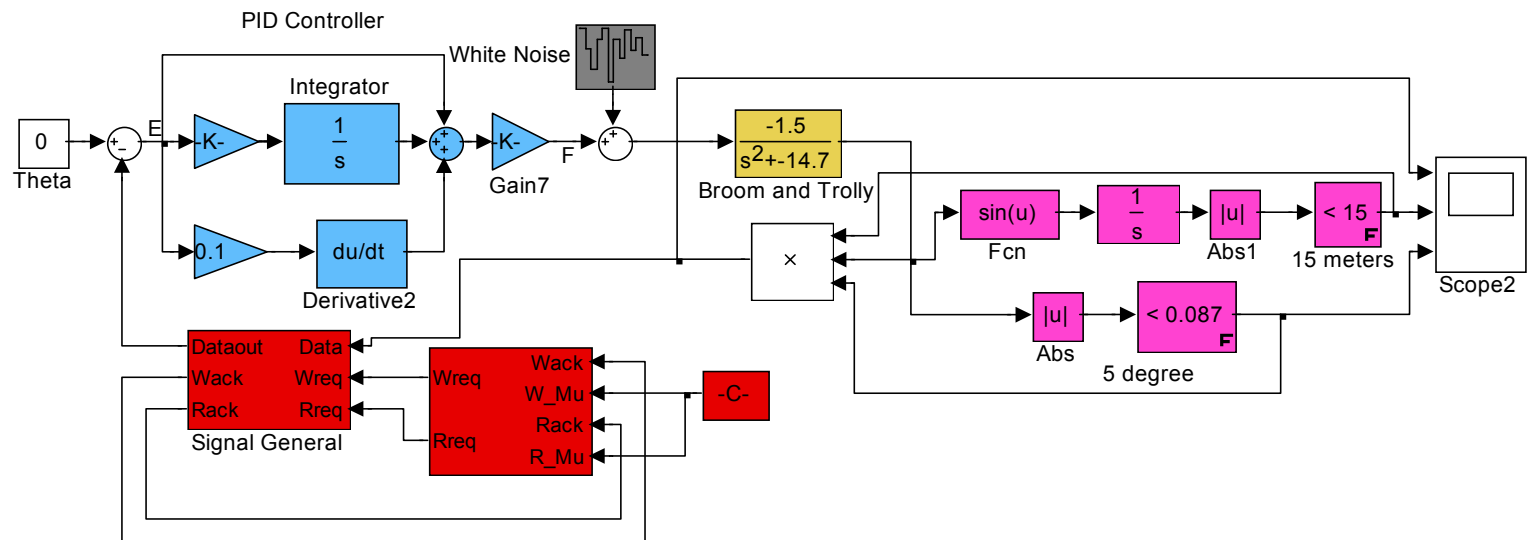
$$\frac{\Theta}{F} = \frac{-3}{s^2 - \frac{3g}{4l}}$$

$$\frac{\Theta}{F} = \frac{-1.5}{s^2 - 14.7}$$



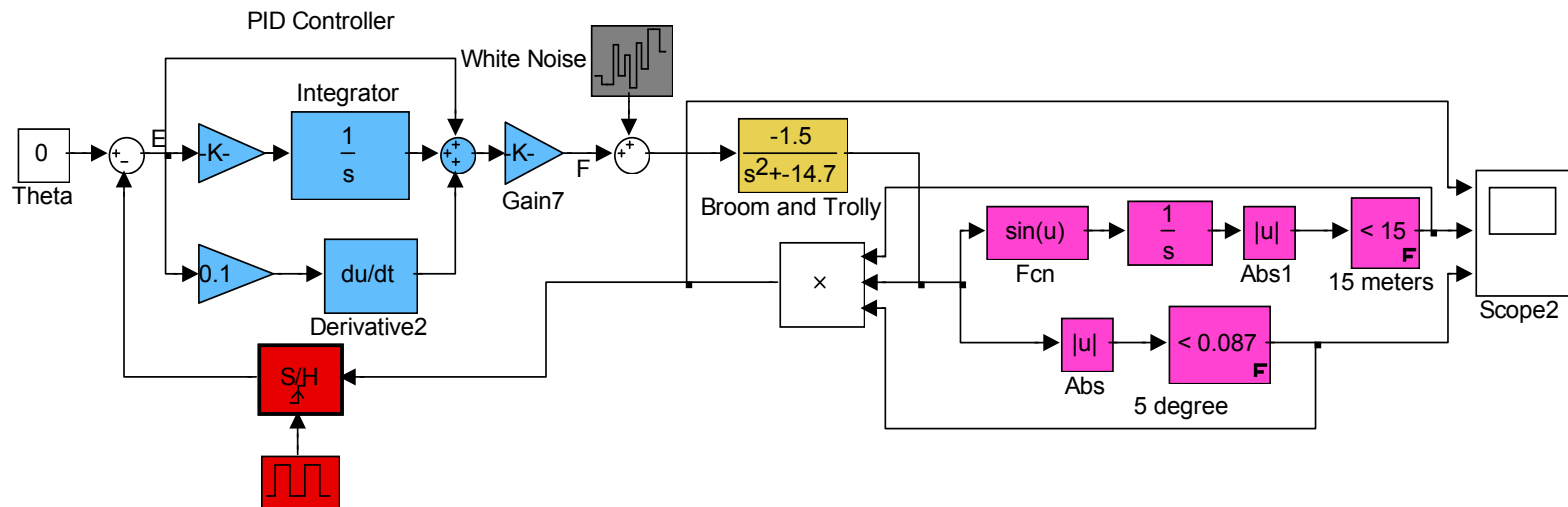
Broom Balancer

- Apply ACM into the system

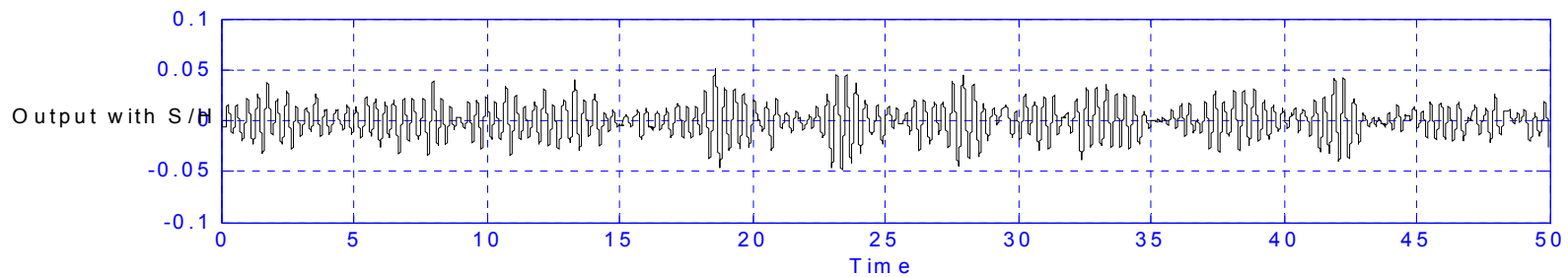
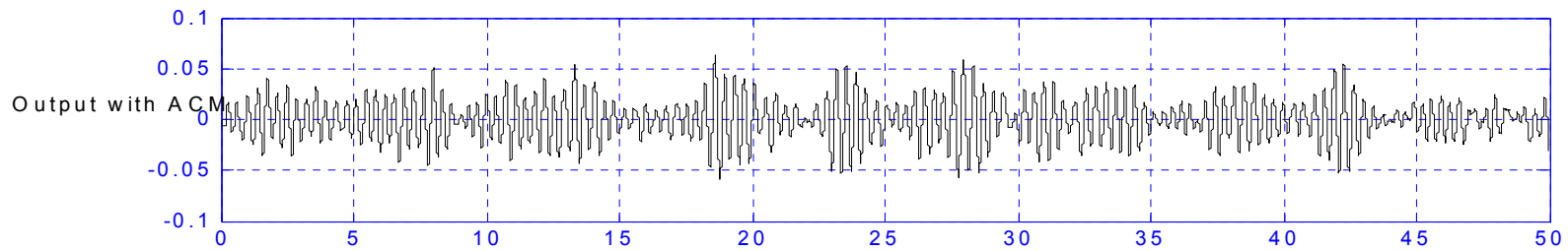
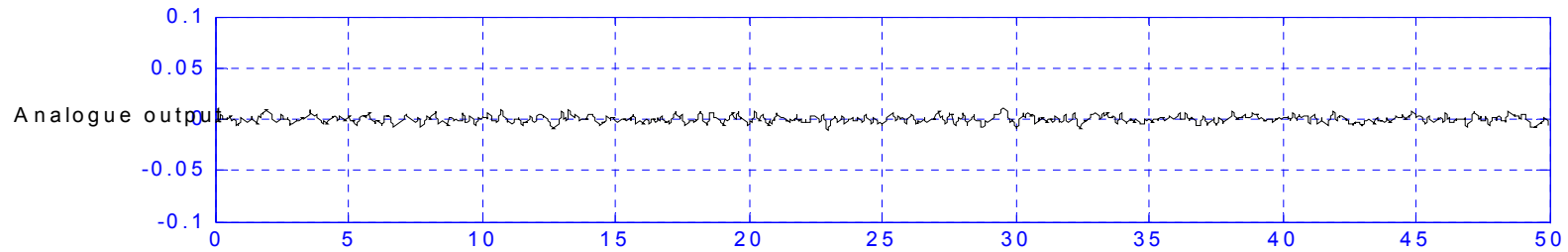


Broom Balancer

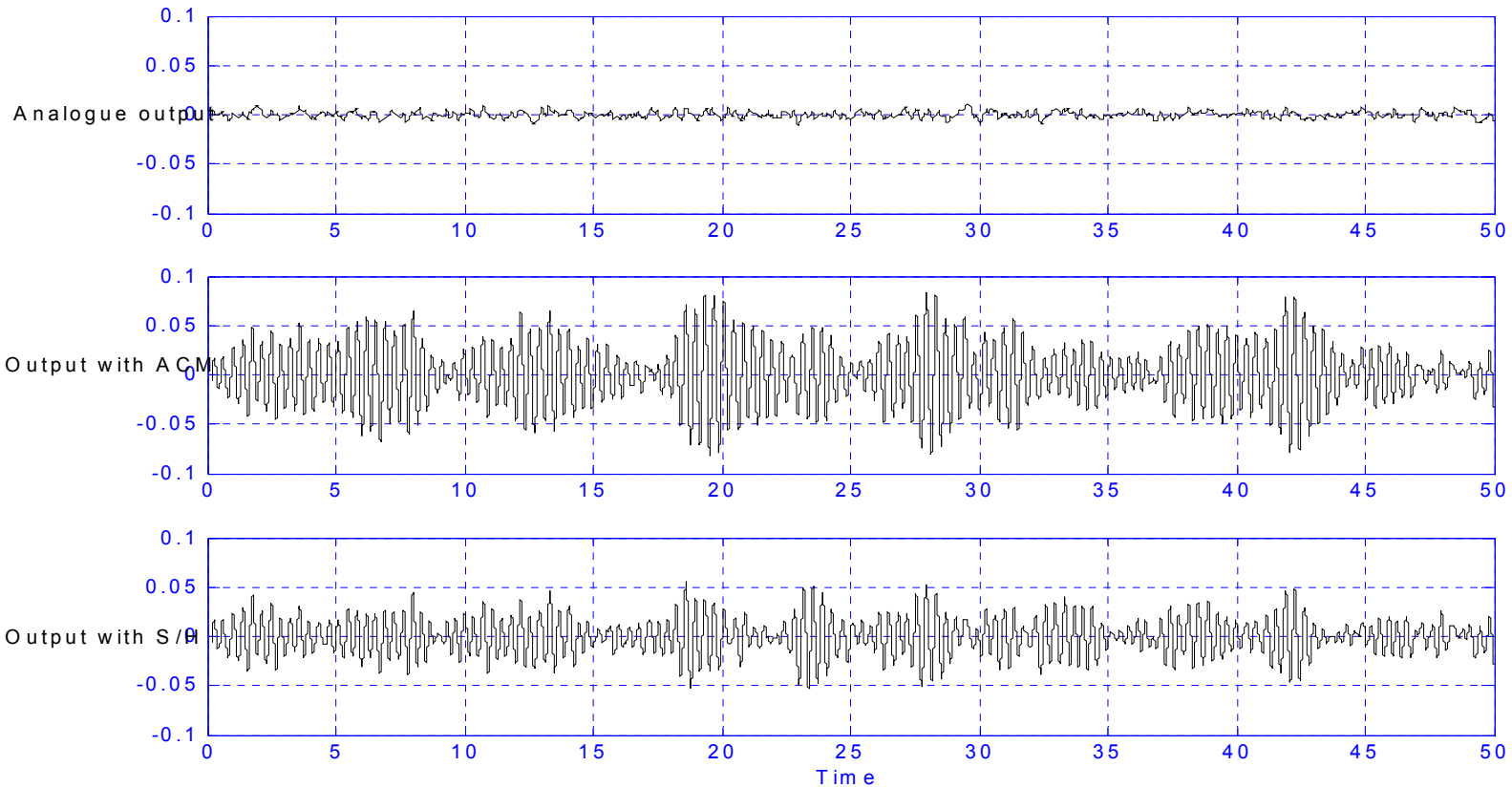
- Apply a Sample and Hold component into the system



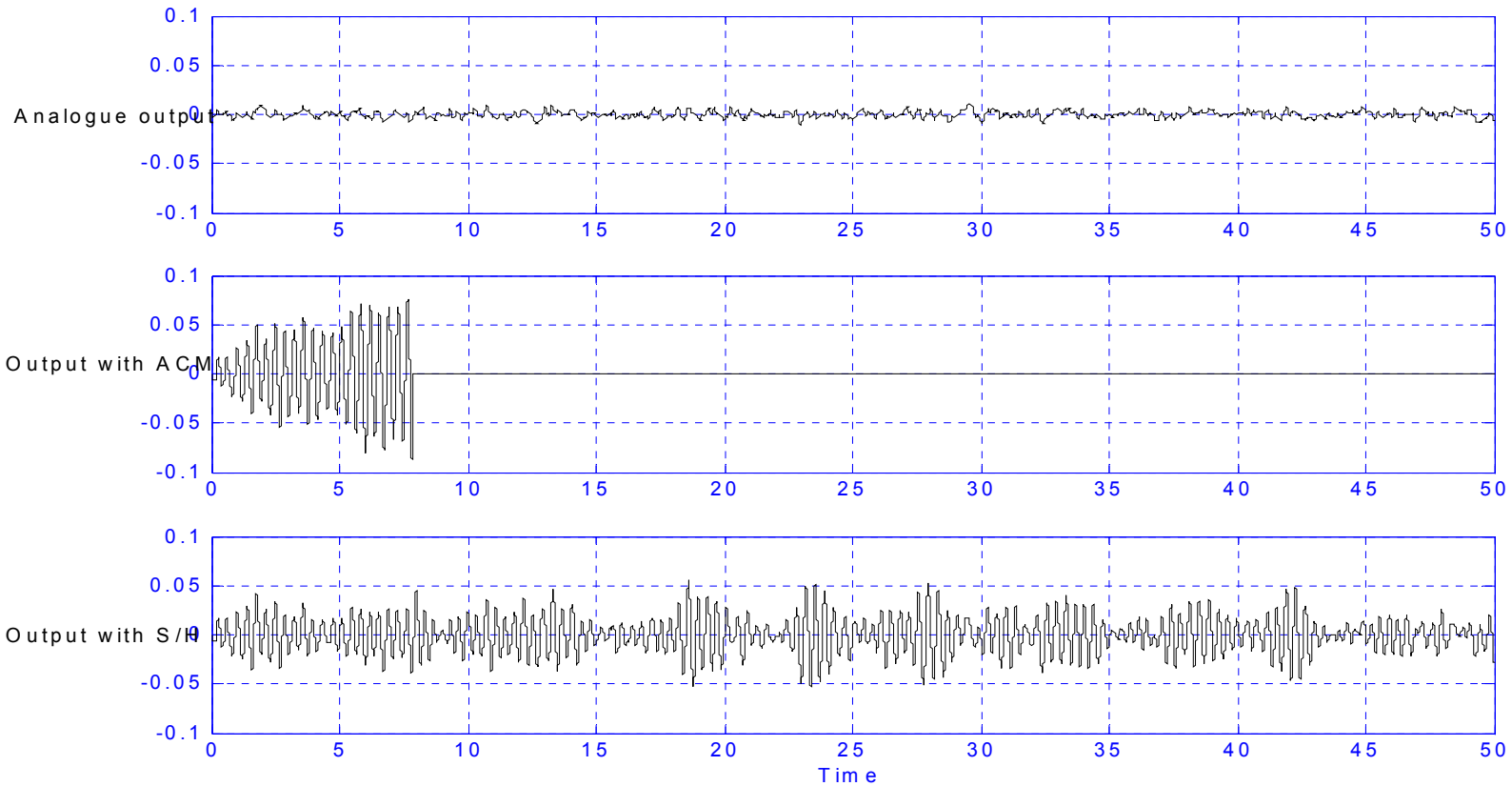
$m=0.0052$



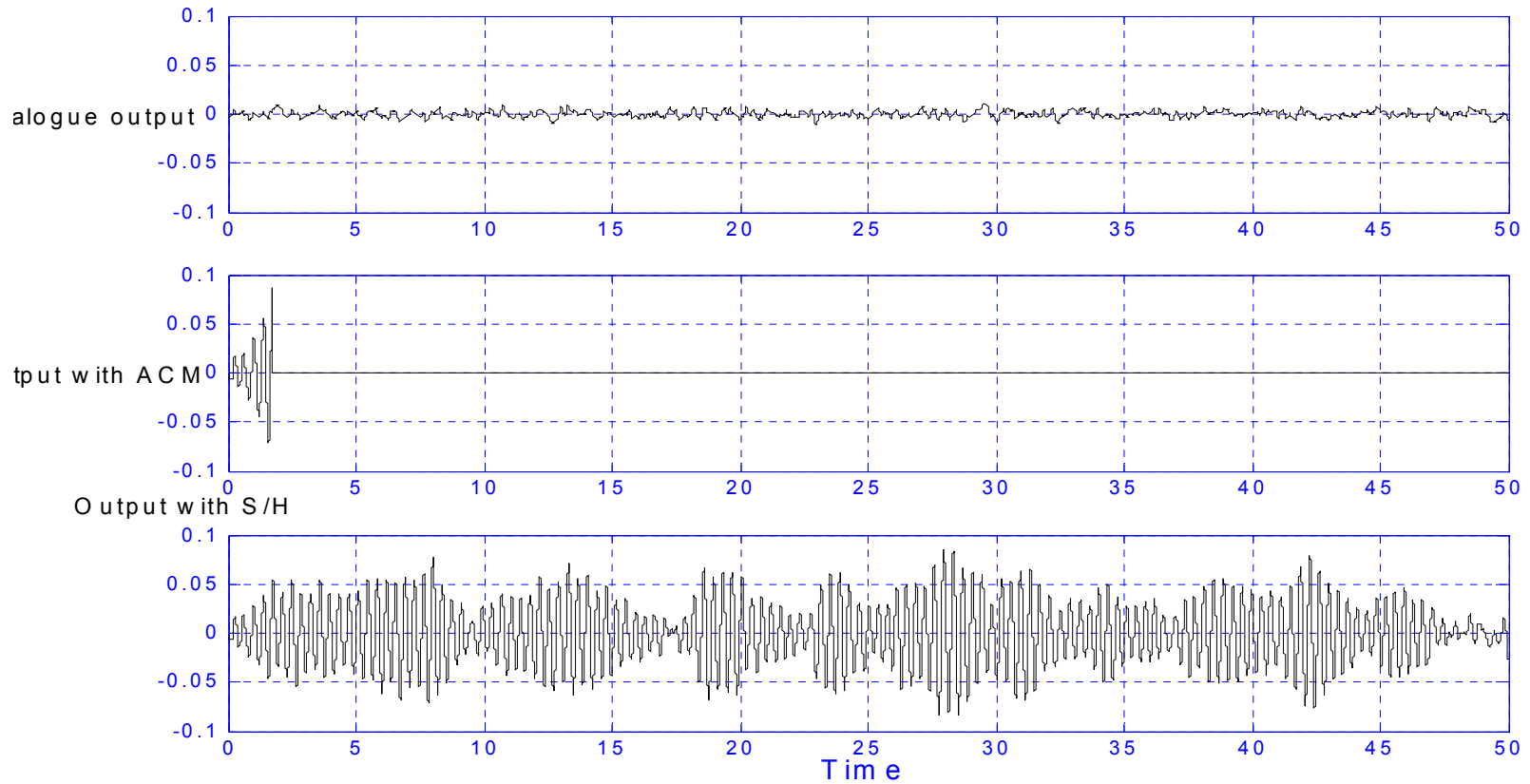
$m=0.0076$



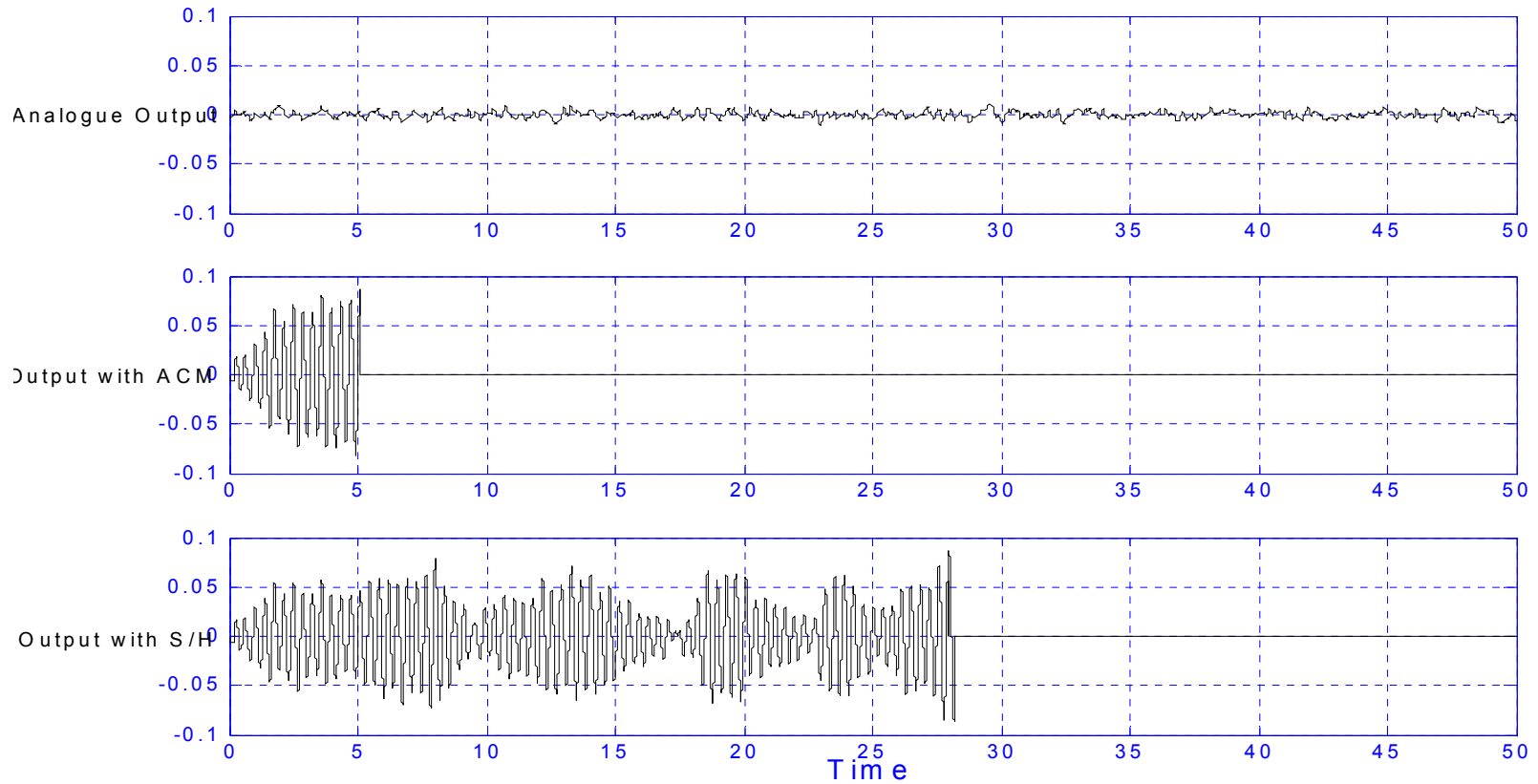
$$m=0.0077$$



$m=0.0131$



$m=0.0132$



Conclusions and Future Works

- **Conclusion**

- Two ACM models were built in MATLAB
- A Control system with a Signal type ACM applied in is modelled

- **Future Works**

- Investigate on the evaluation methods