

UNIVERSITY OF
NEWCASTLE



ACM Model in Control System

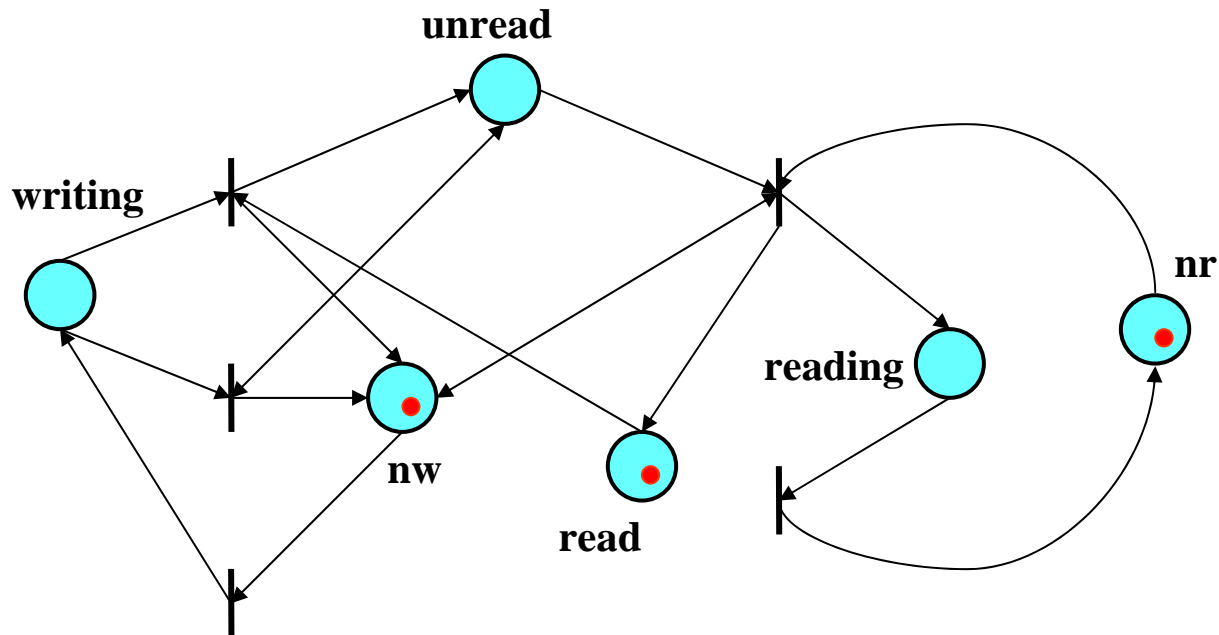
Coherent Meeting in
the University of Newcastle upon Tyne

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**

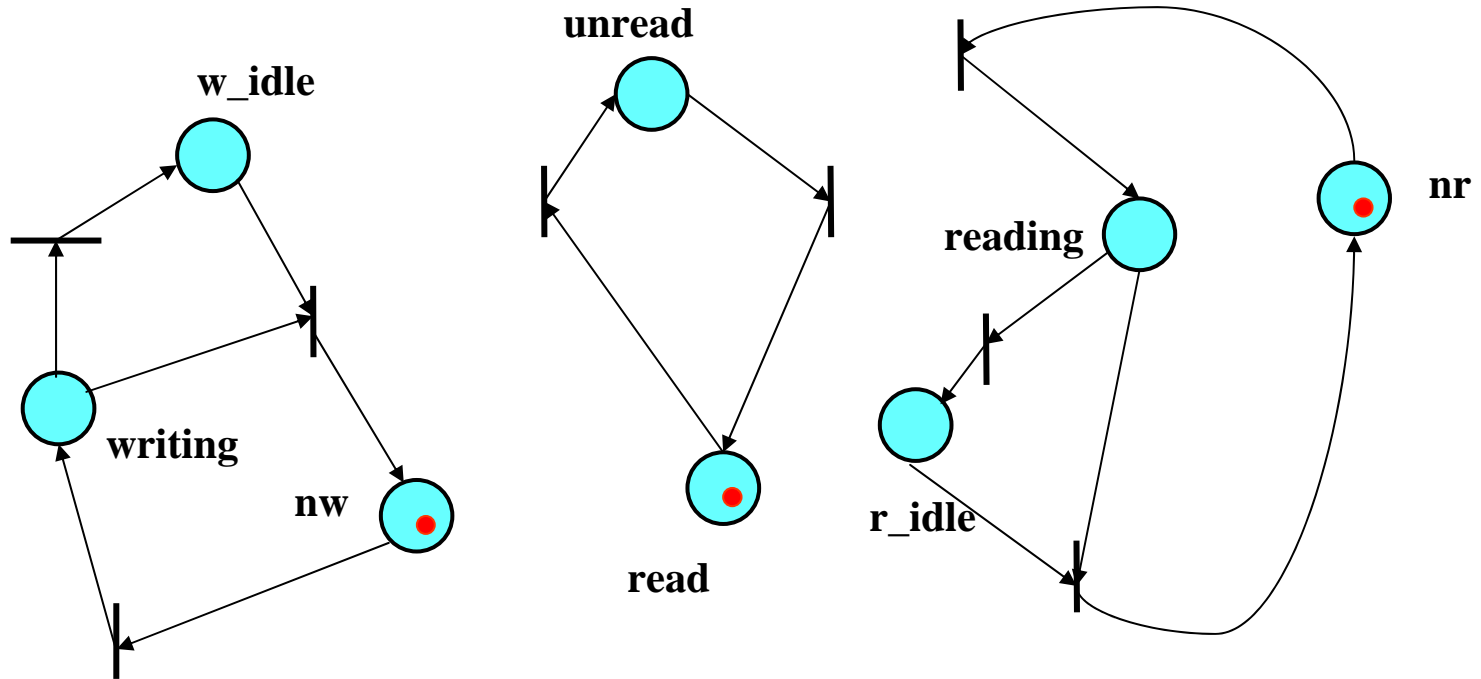
General Signal Model

- The Petri Net Model

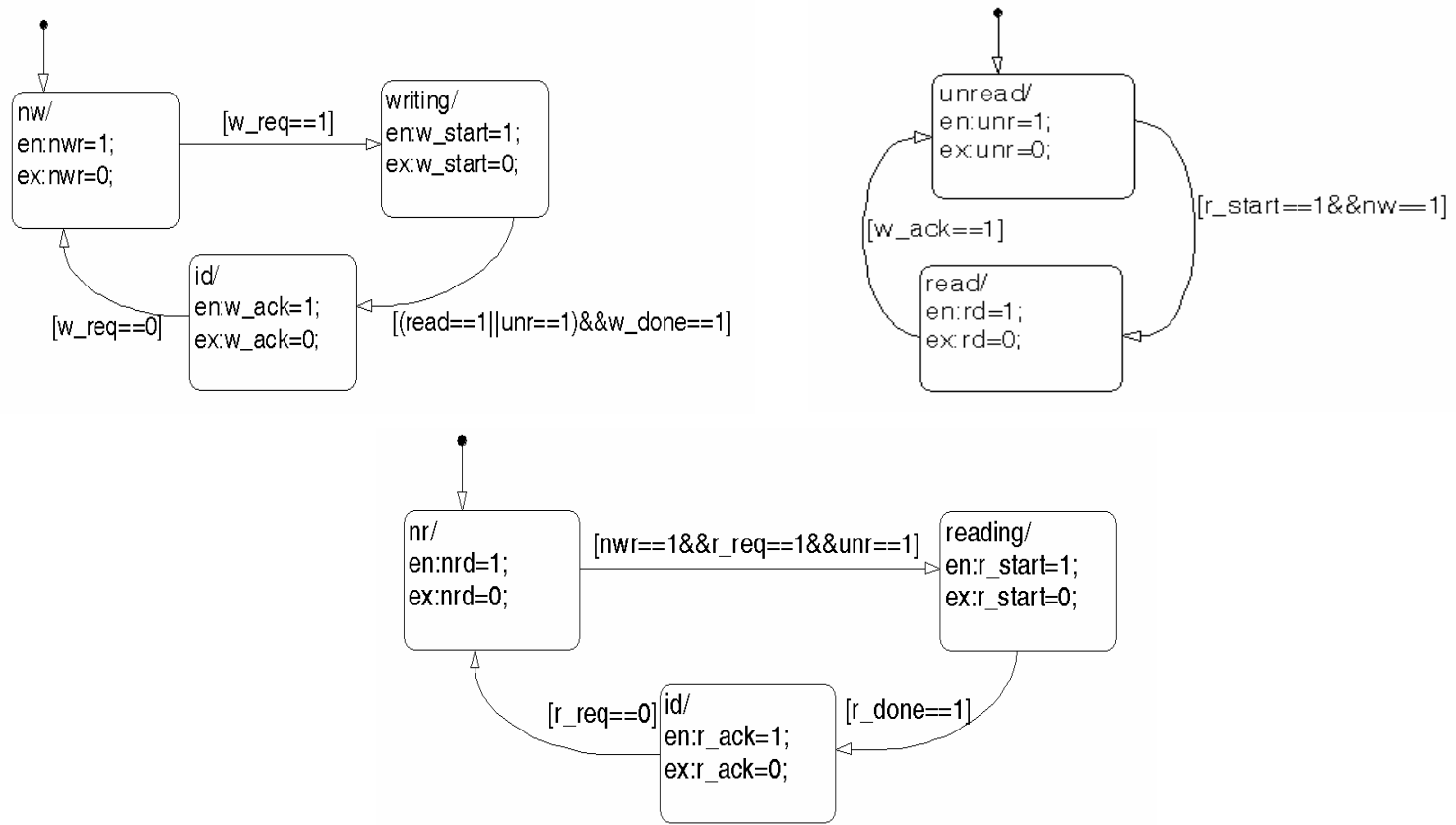


General Signal Model

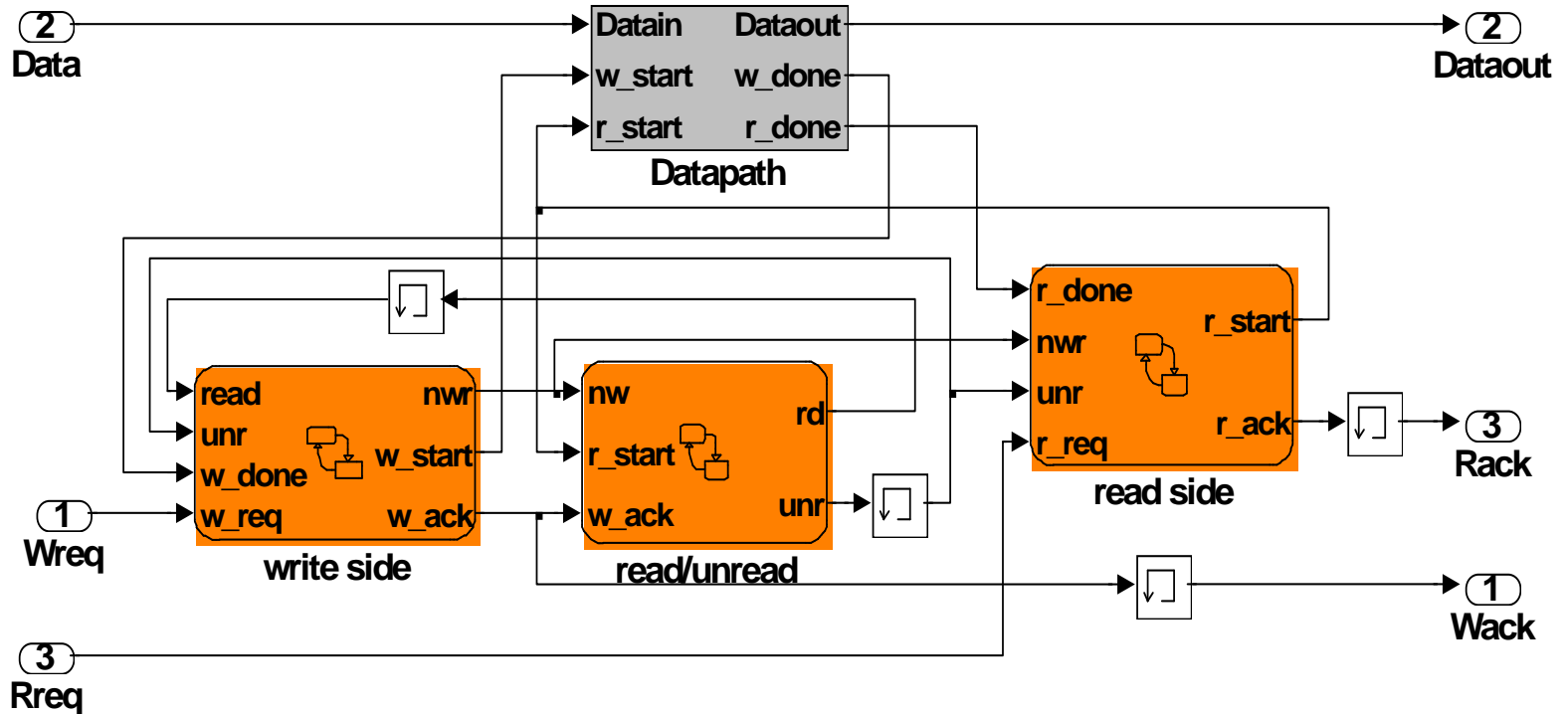
- Divide it into 3 parts



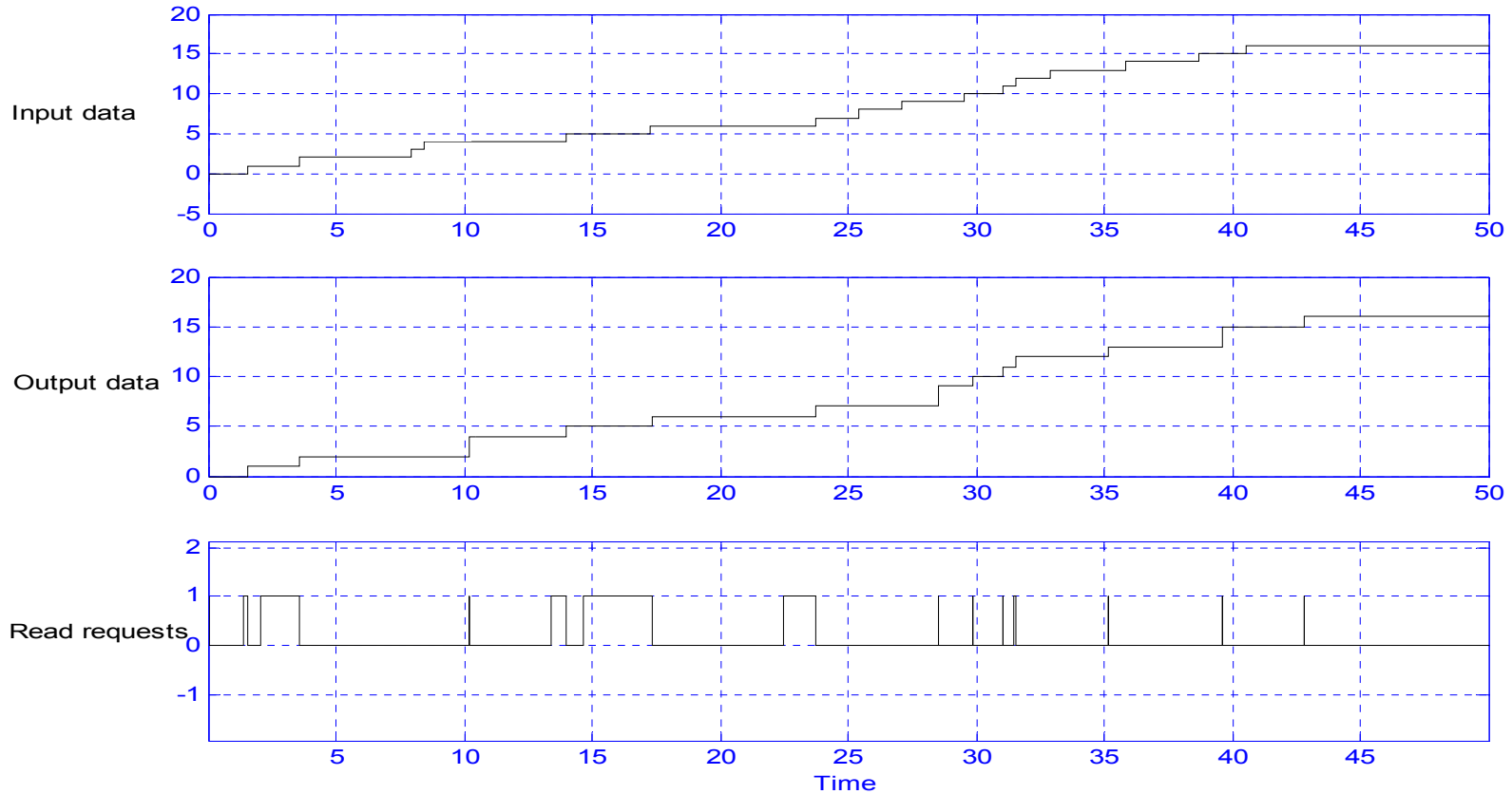
Stateflow Model



Model in Simulink



Simulation Results



RR-BB Algorithm

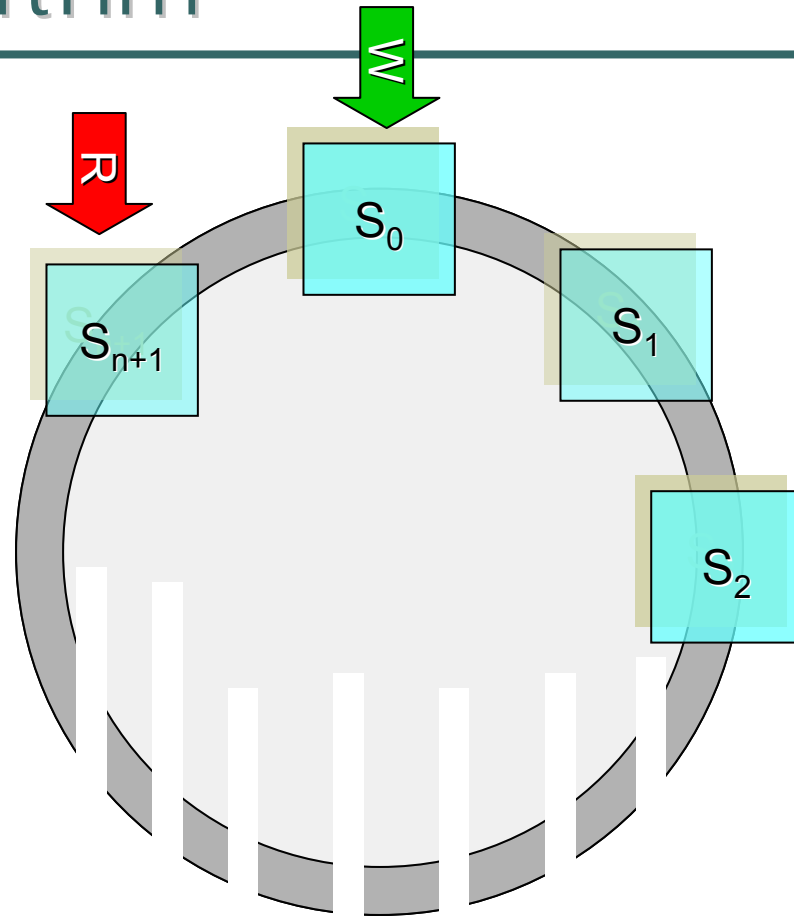
Global view

Re-reading

Writing

Reading

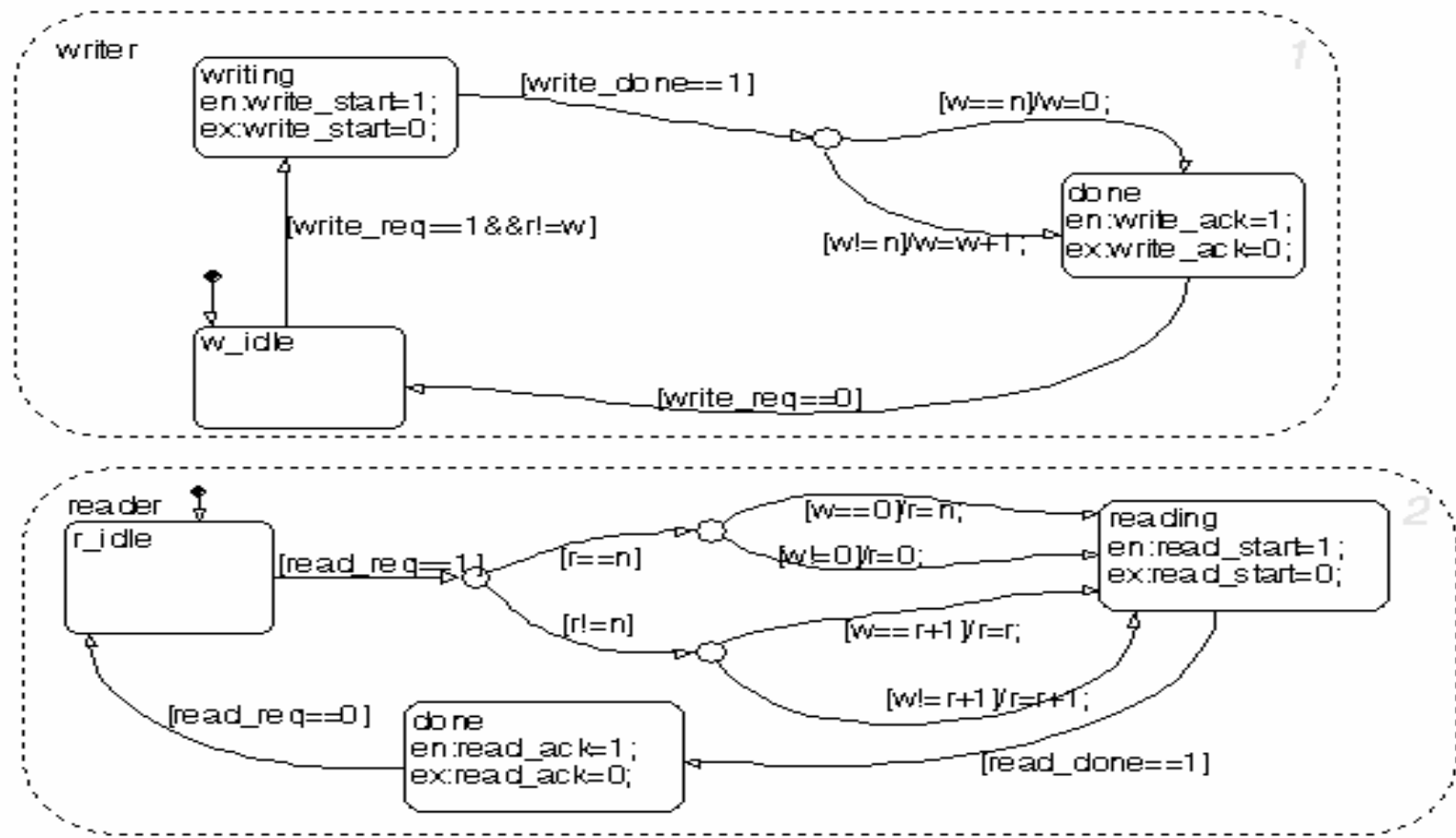
Writer waiting



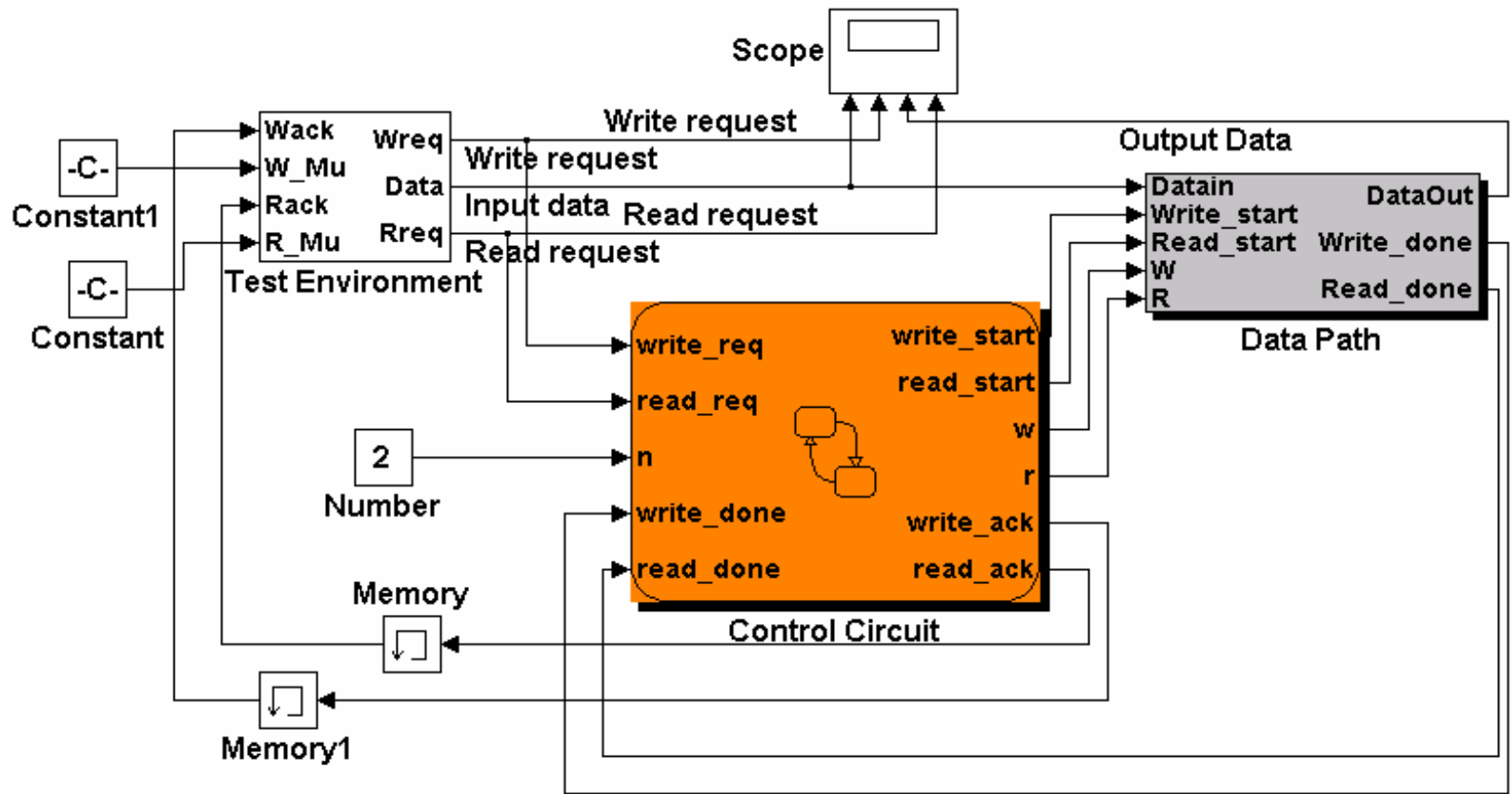
RR-BB Algorithm

- var $w: 0 \dots n+1$; $r: 0 \dots n+1$;
- **writer:**
wr: write w ; w0: $w := (w+1 \bmod n+1)$; wait until $r \neq w$;
- **reader:**
r0: if $(r+1 \bmod n+1) \neq w$ then $r := (r+1 \bmod n+1)$;
rd: read r ;

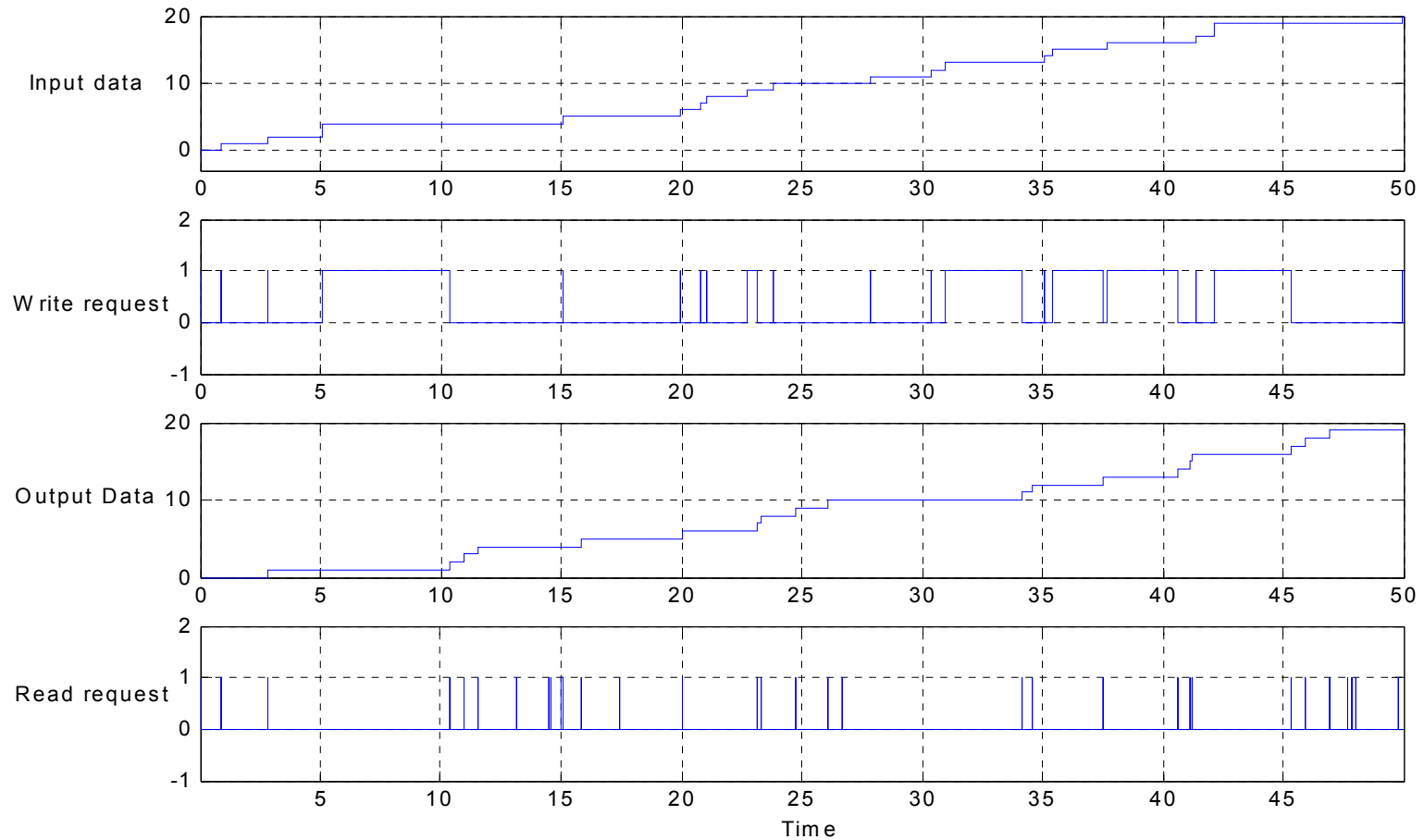
Stateflow Model



Model in Simulink



Simulation Results



2004-1-9

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University

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;

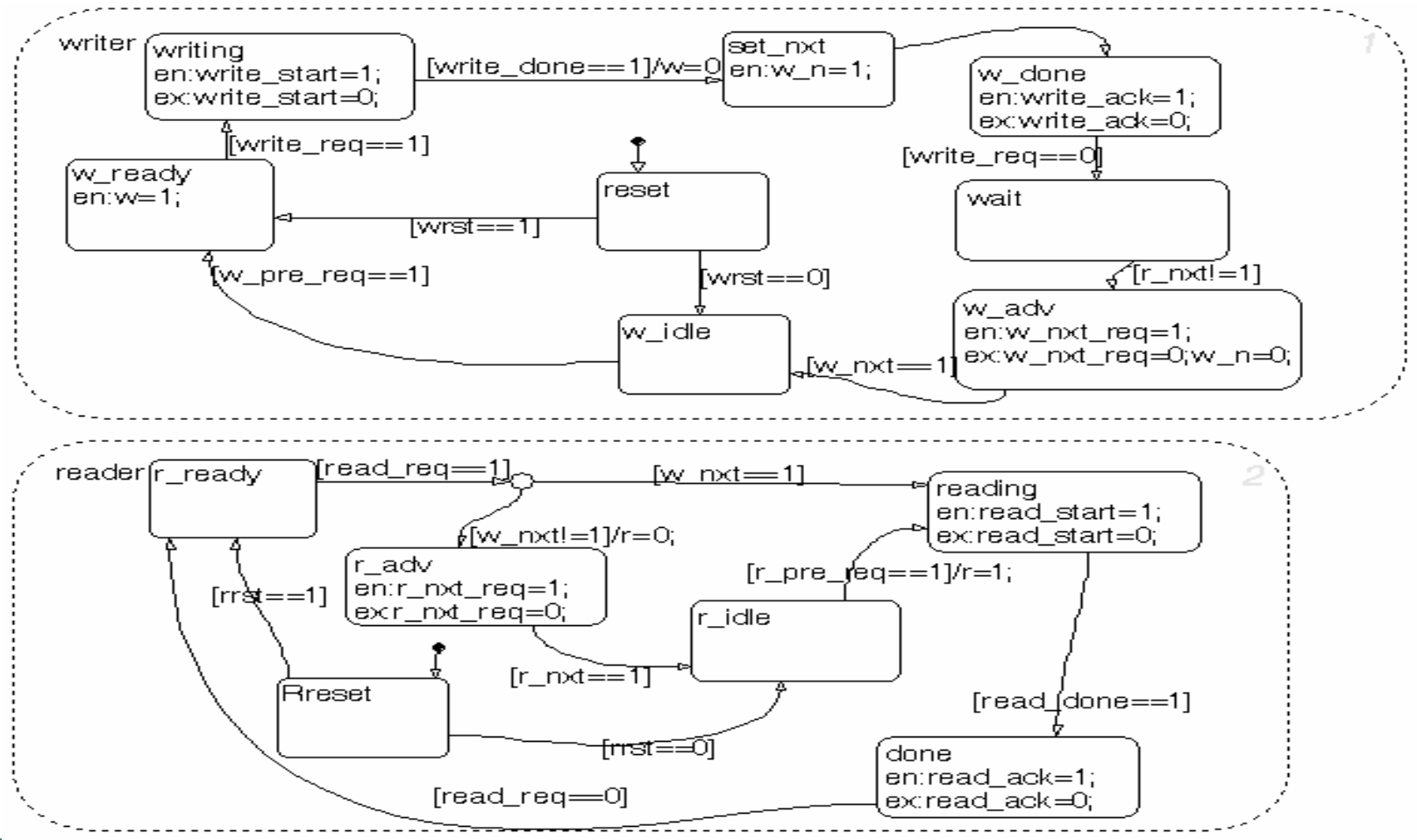
- **reader:**

r0: if wnext!=1 then

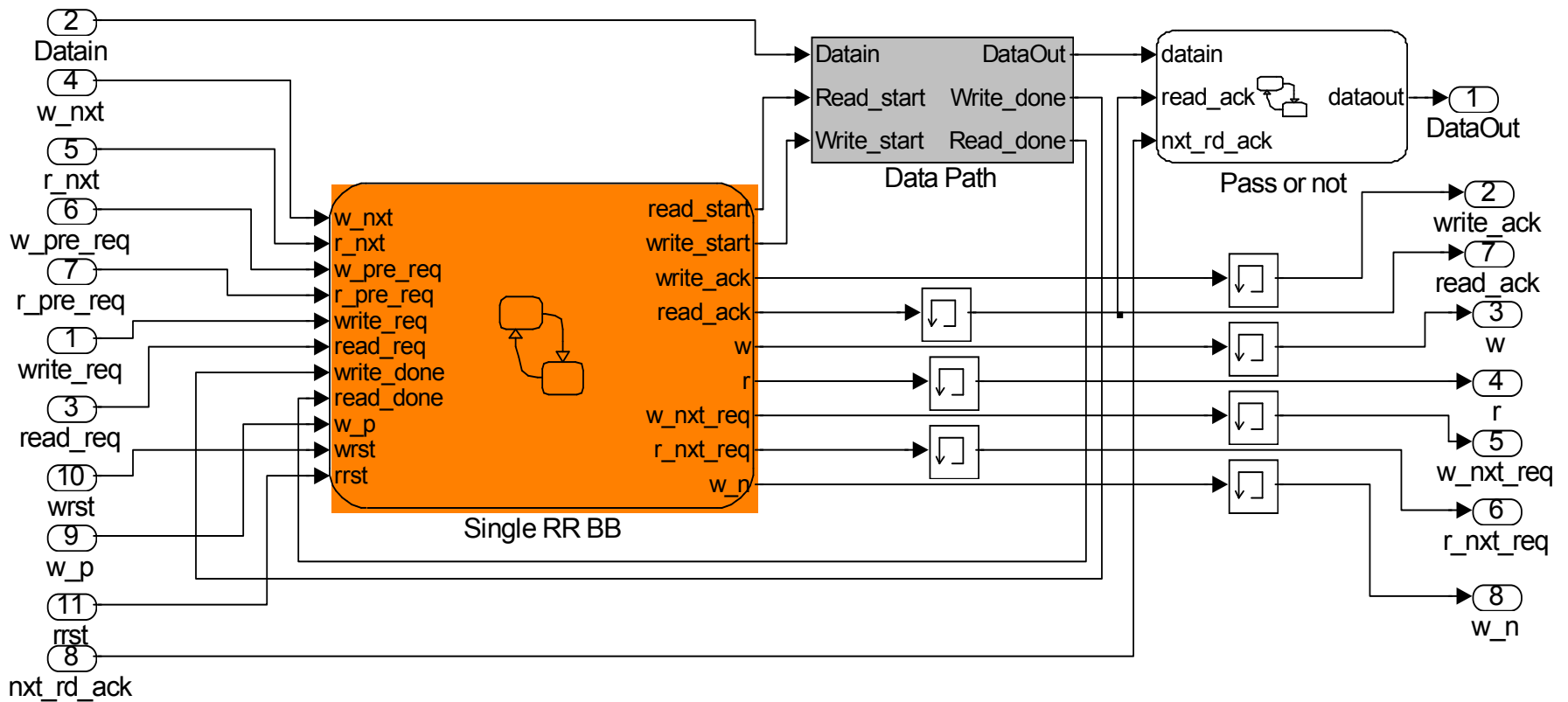
begin r:=0, rnext:=1, advance end;

rd: read;

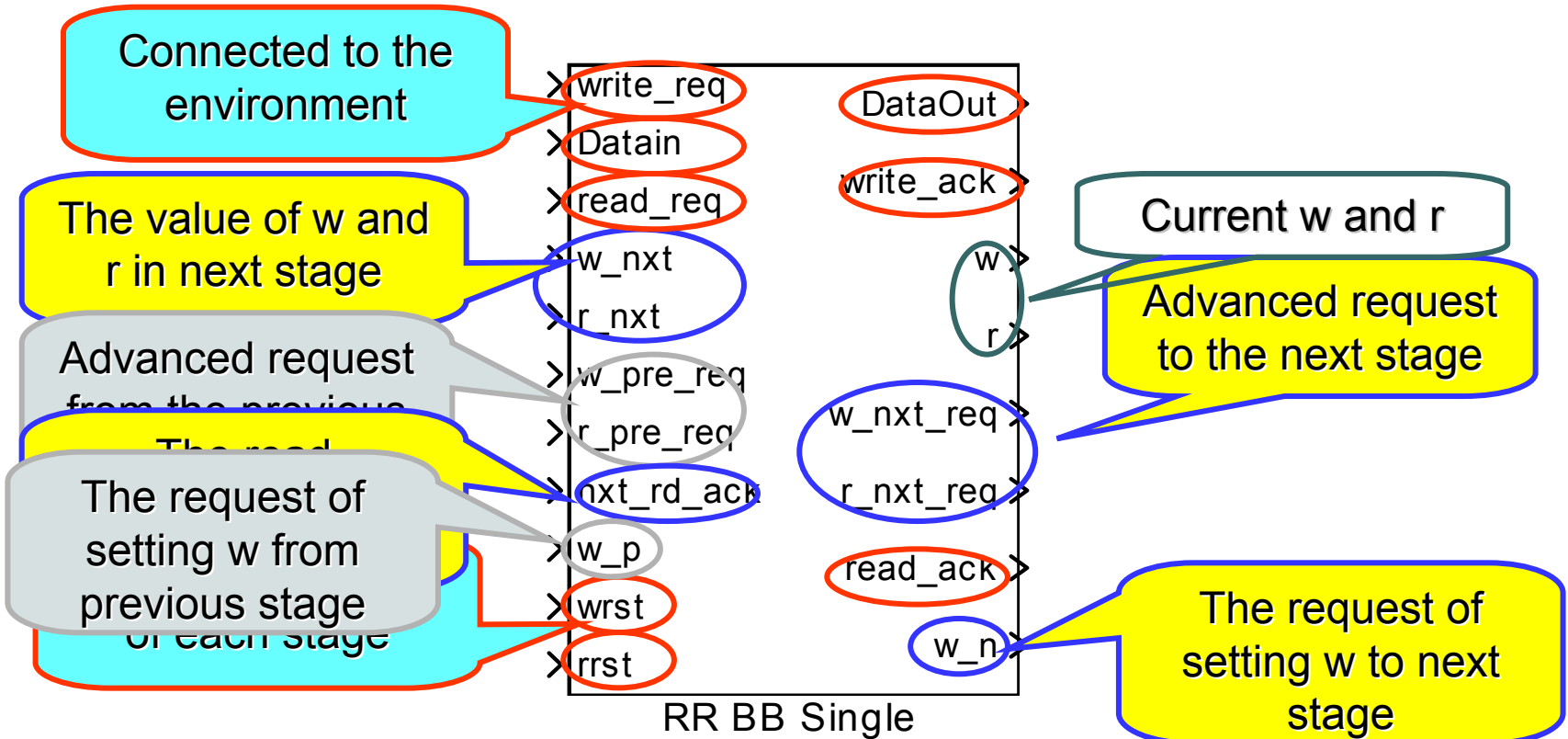
Stateflow Model



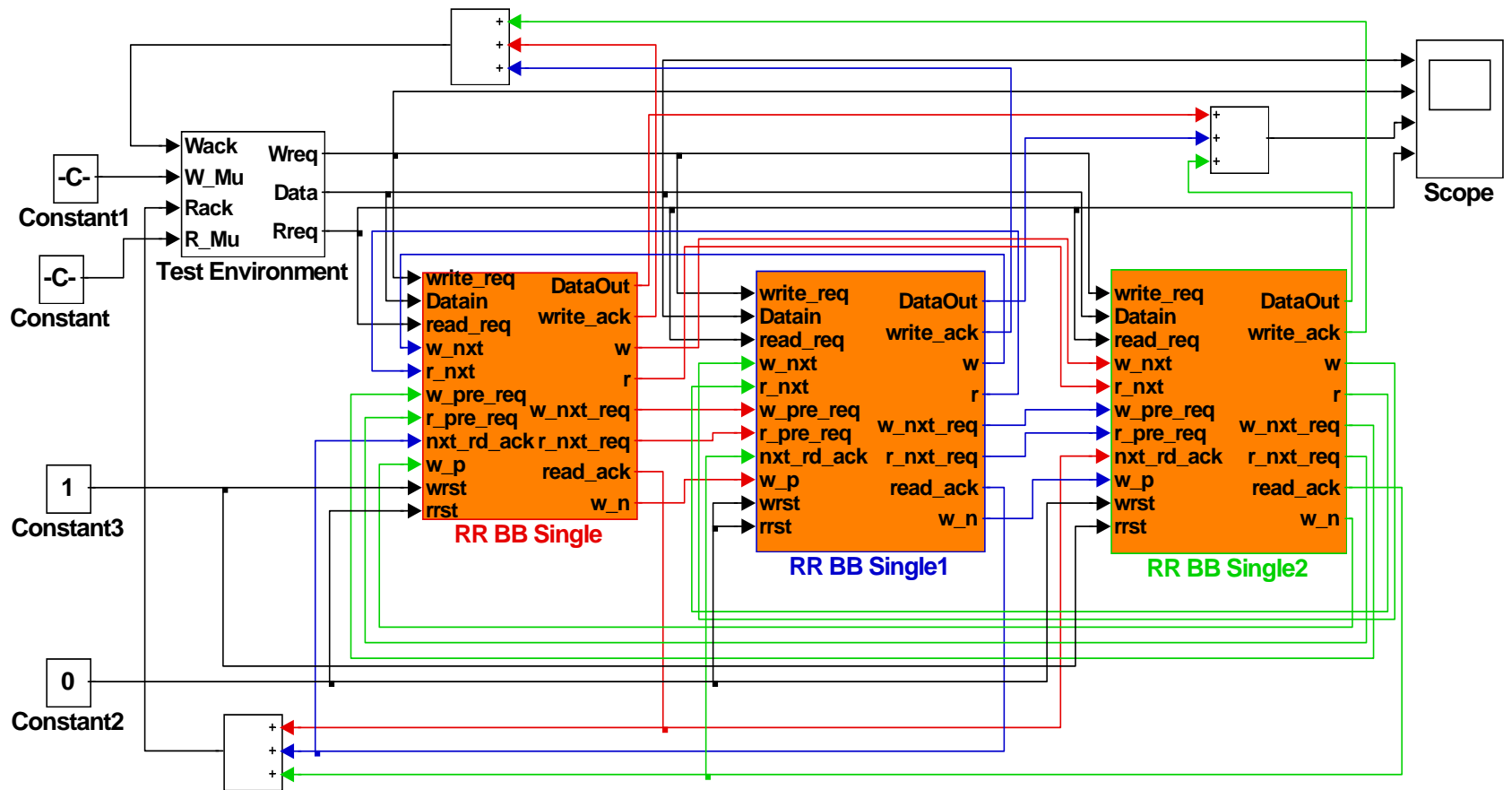
Single Stage



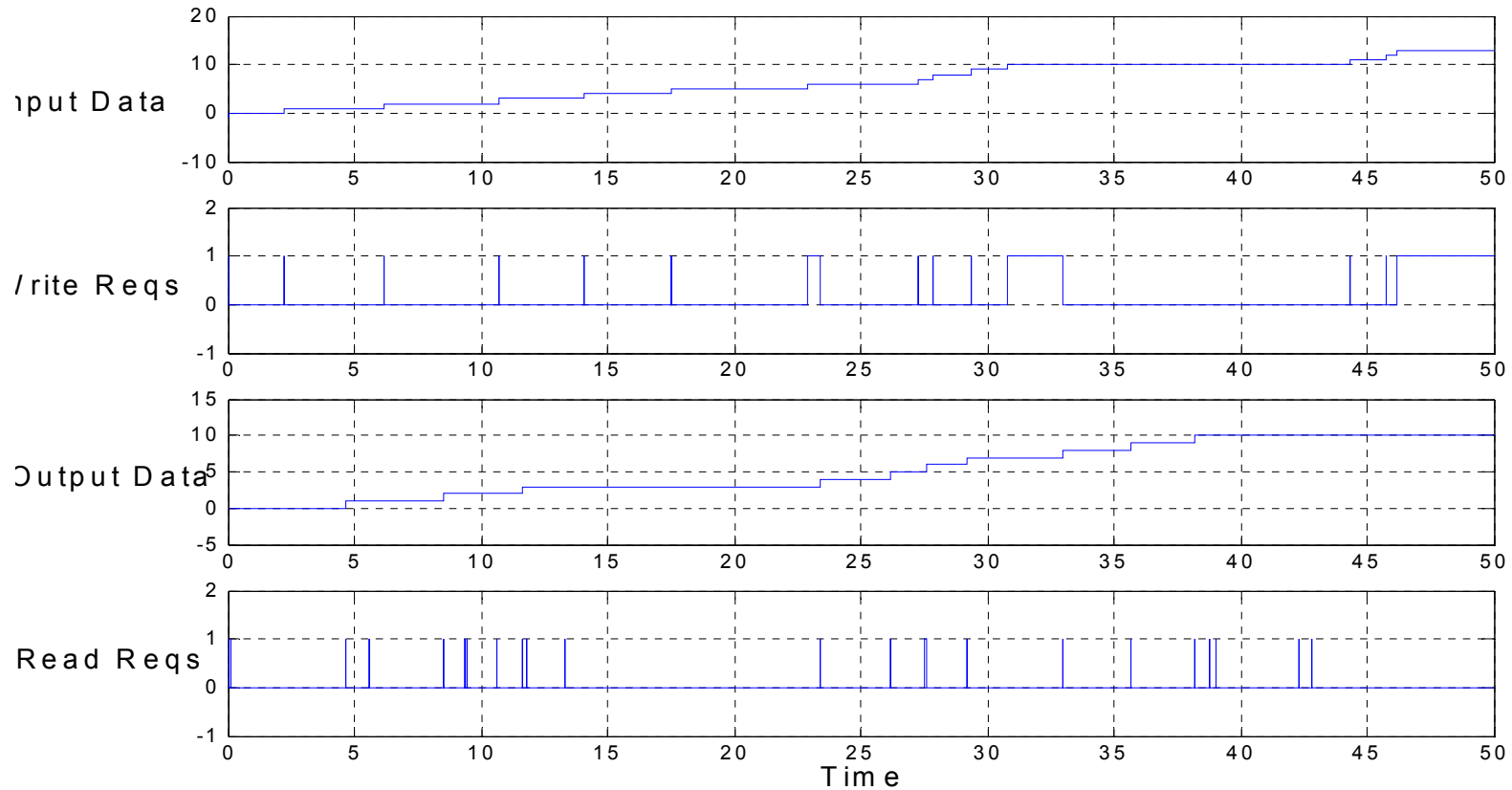
Single Stage



Model in Simulink

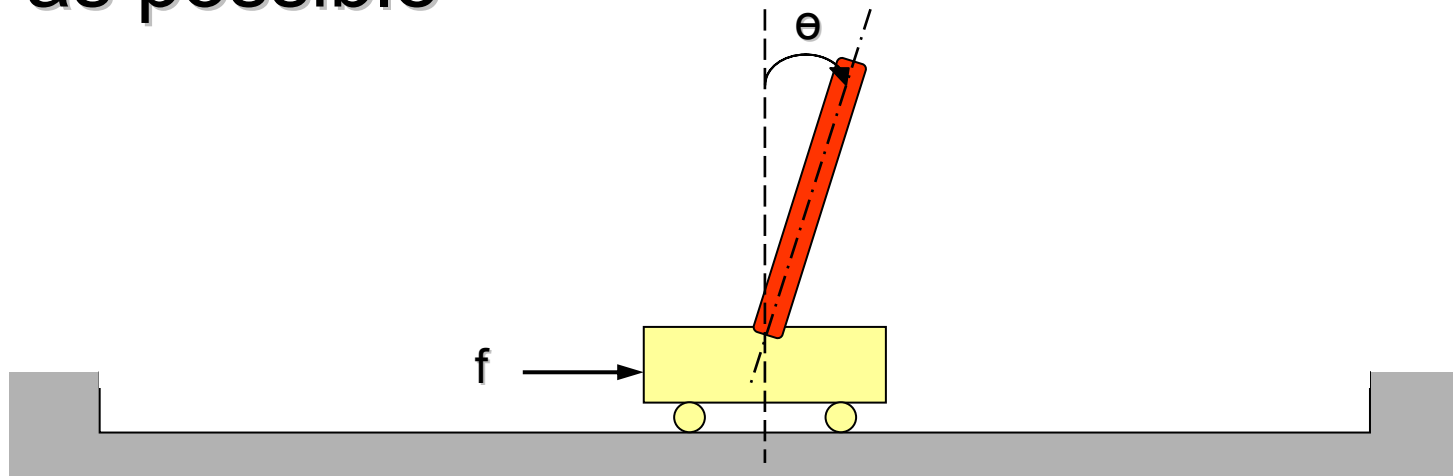


Simulation Results



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

$$x'' = \frac{F + \dots}{M}$$

$$\theta'' = \frac{g \theta + \dots}{l \left[\frac{4}{3} \right]}$$

- Approximated by a linear model

$$x'' = \frac{F}{M}$$

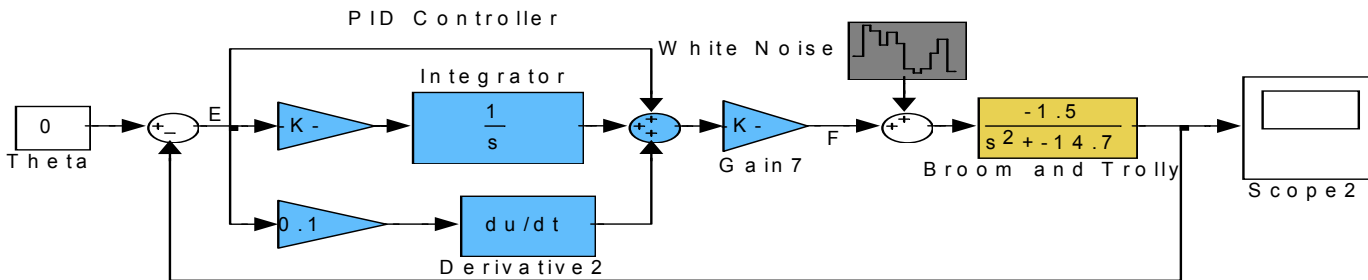
$$\theta'' = \frac{3g\theta}{4l} - \frac{3F}{4Ml} = \frac{3}{4Ml} (Mg\theta - F)$$

Broom Balancer

- Broom and Trolley

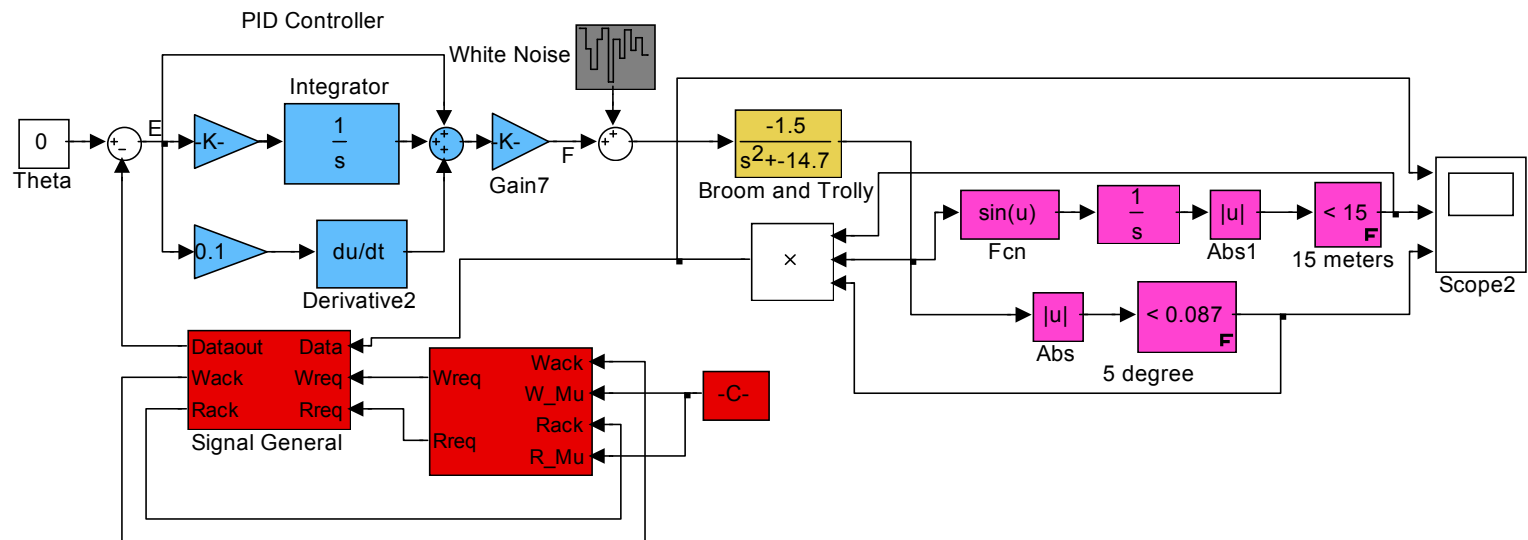
$$\frac{\Theta}{F} = \frac{-3}{s^2 - \frac{3g}{4l}}$$

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



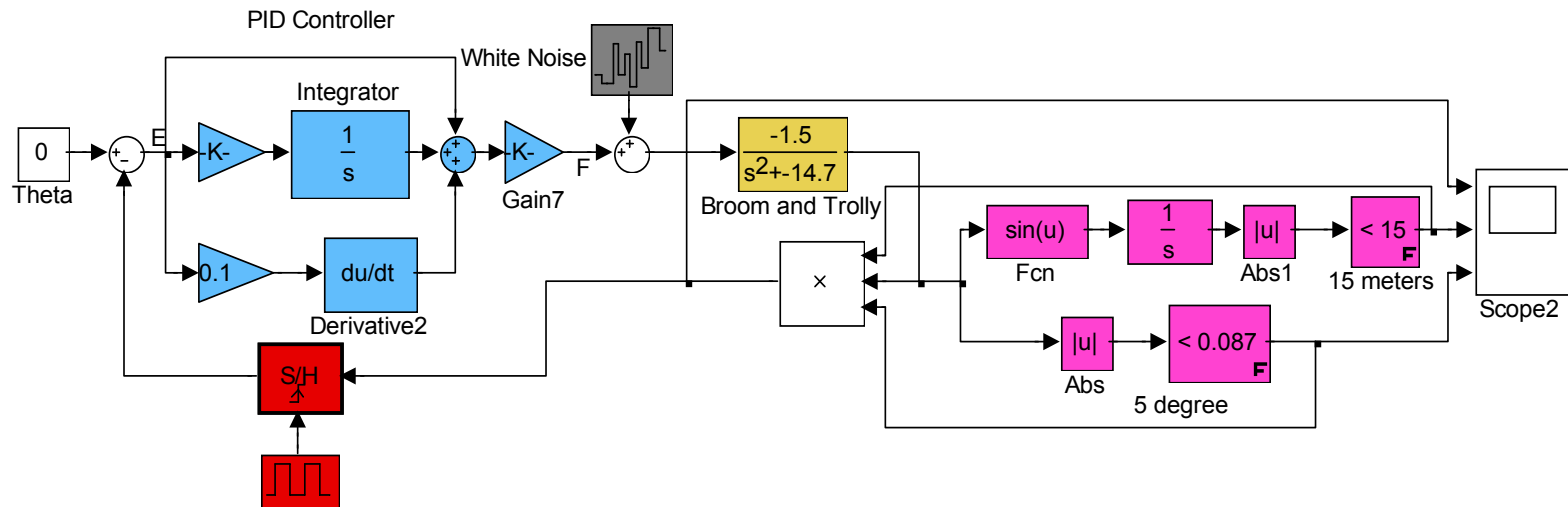
Broom Balancer

- Apply ACM into the system

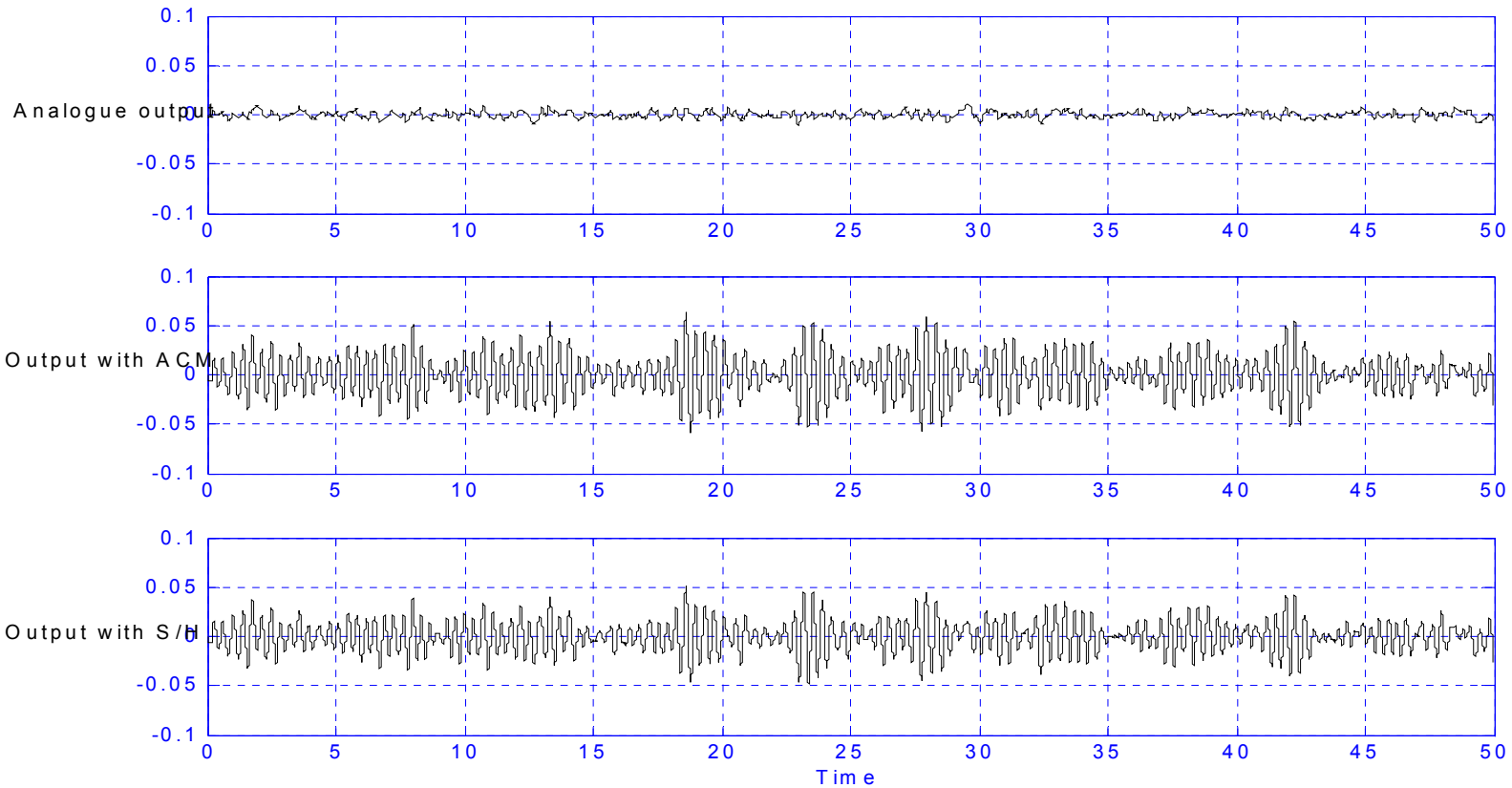


Broom Balancer

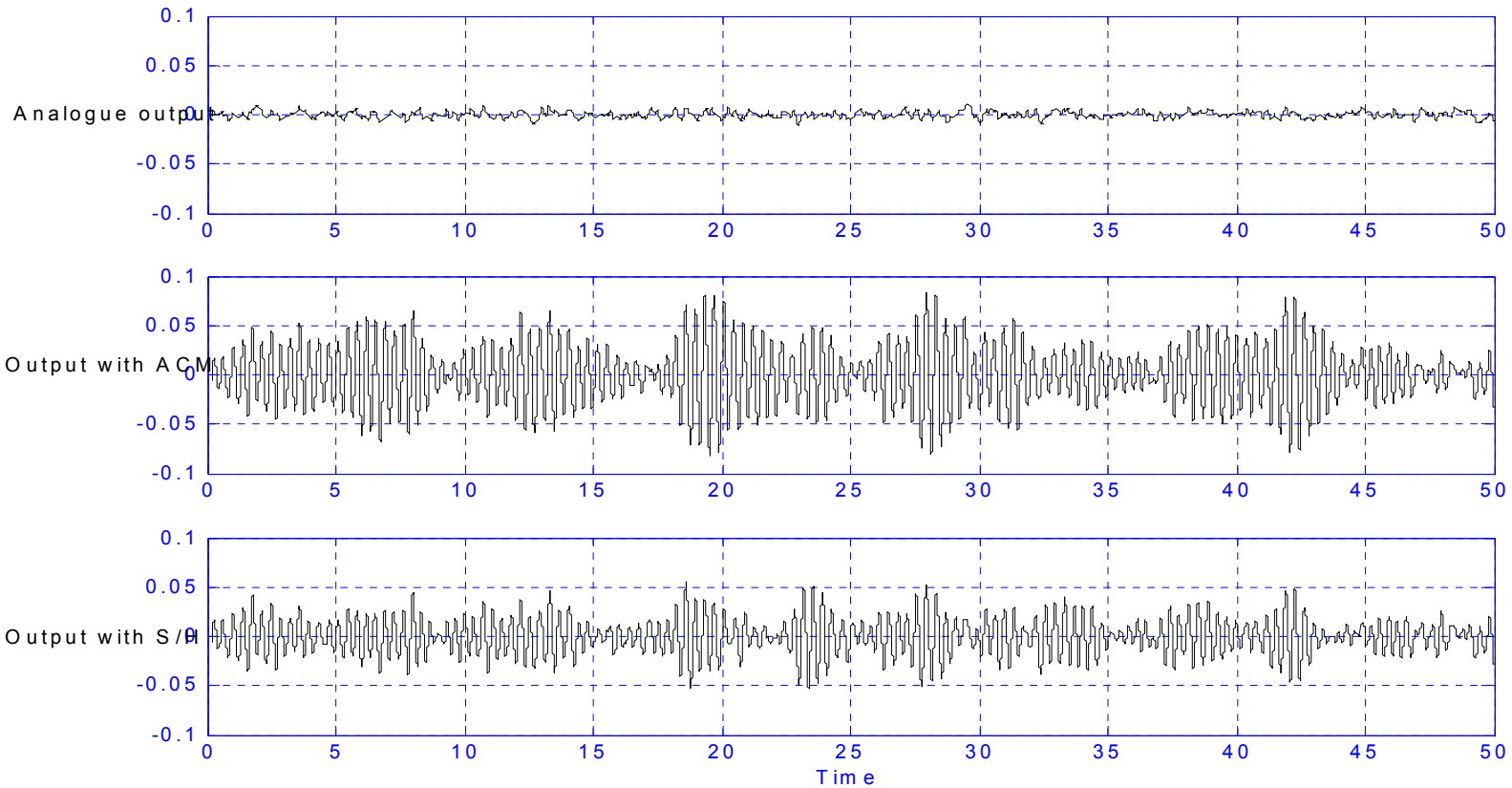
- Apply a Sample and Hold component into the system



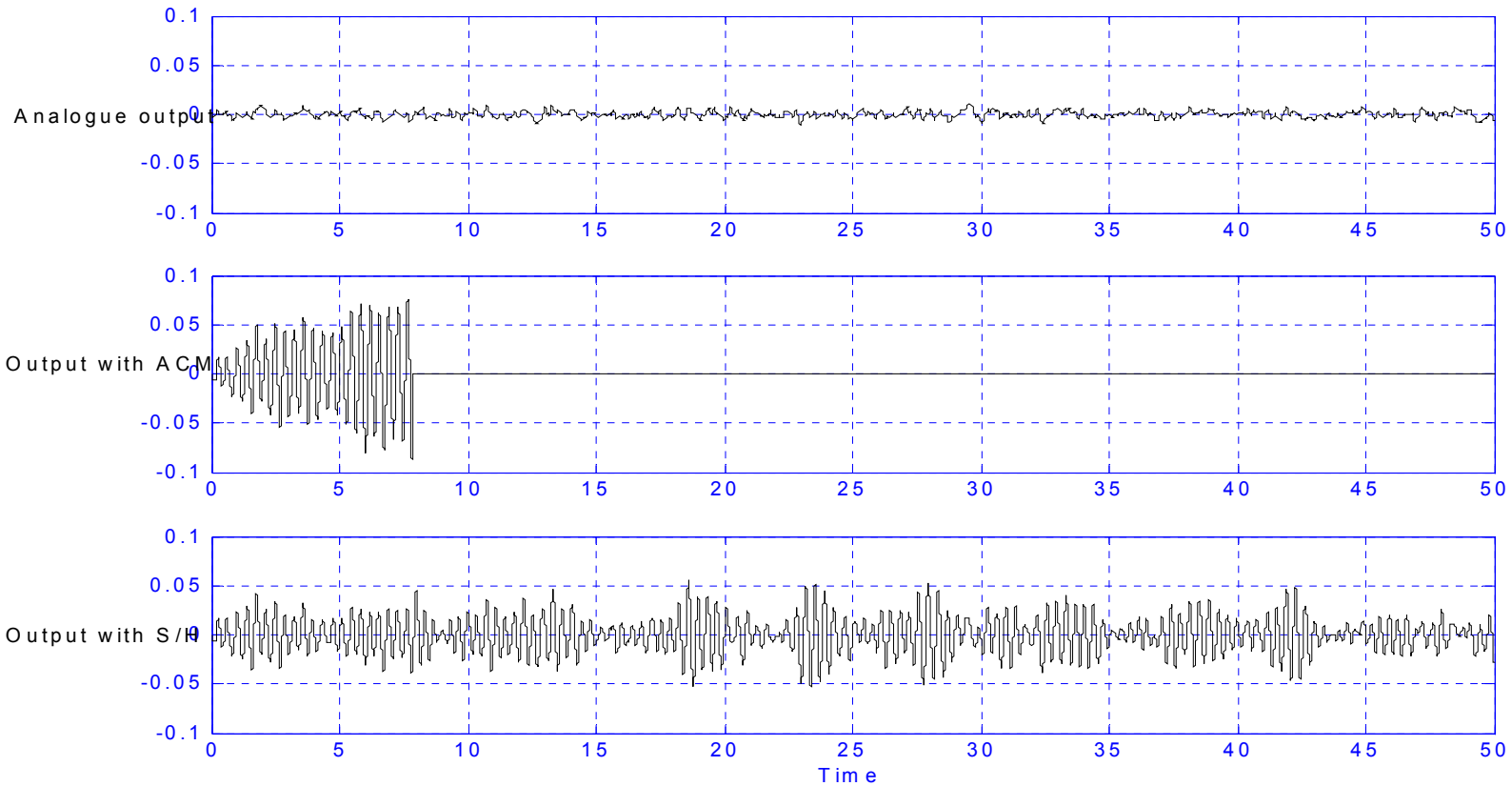
$m=0.0052$



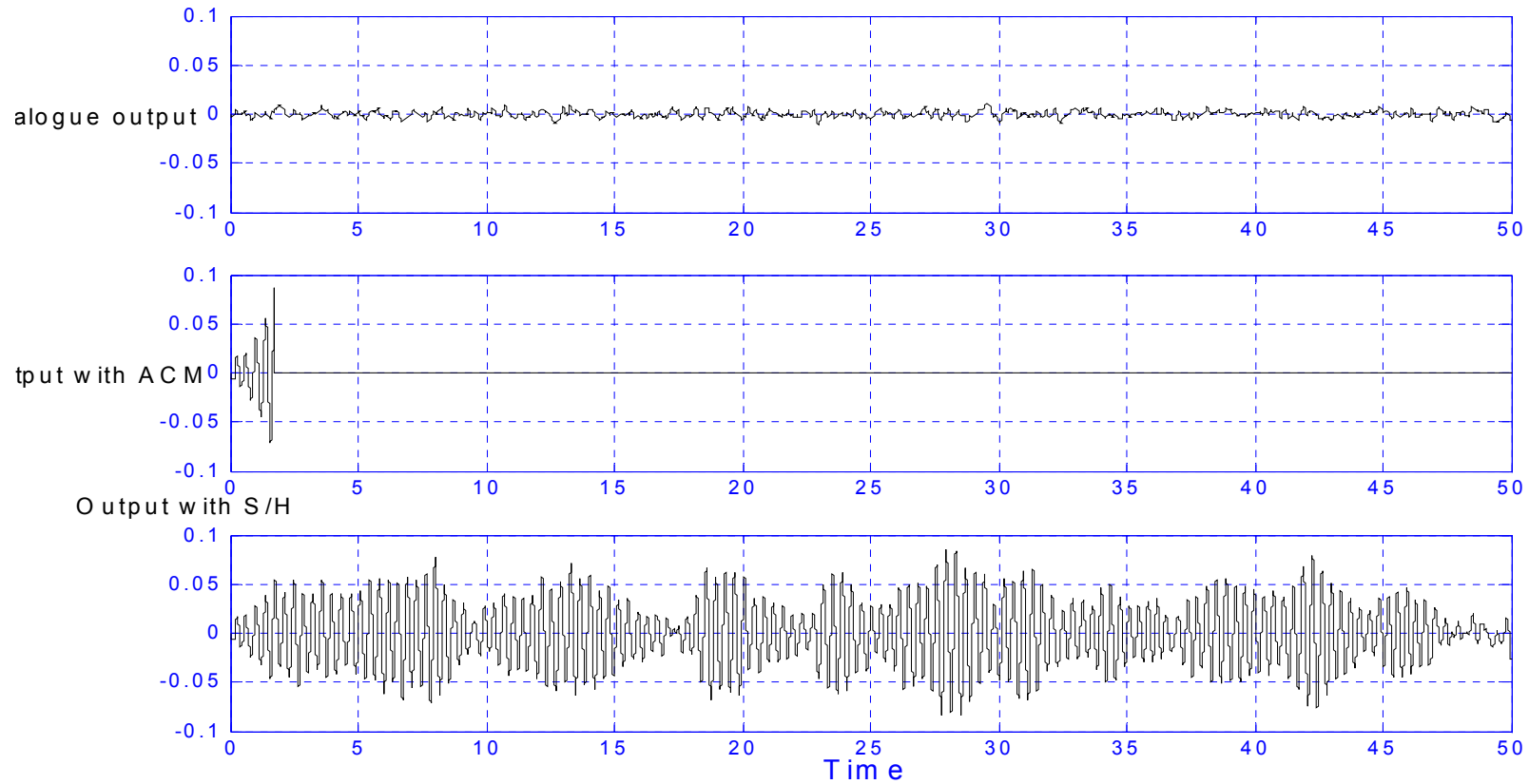
$m=0.0076$



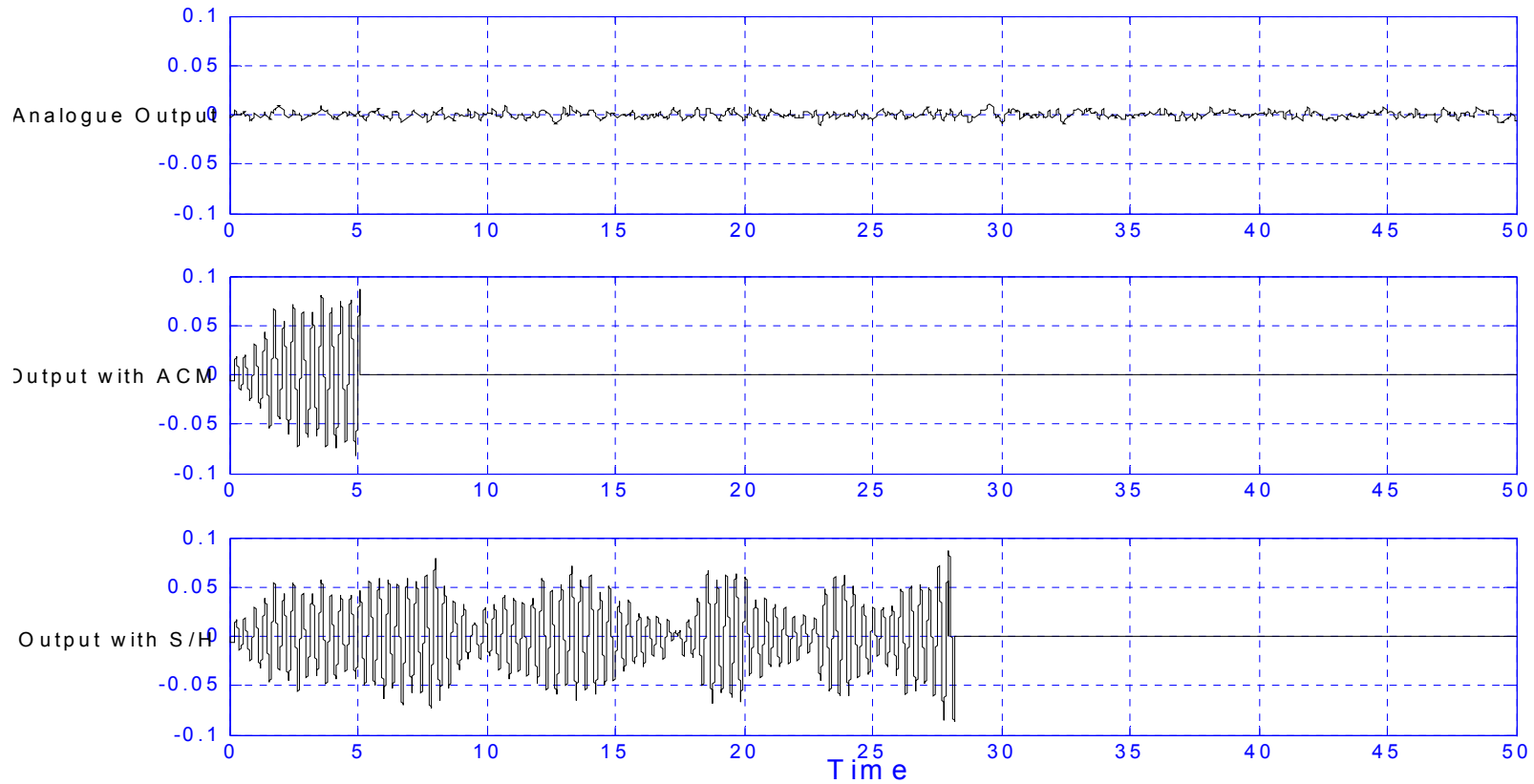
$$m=0.0077$$



$m=0.0131$



$m=0.0132$



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