

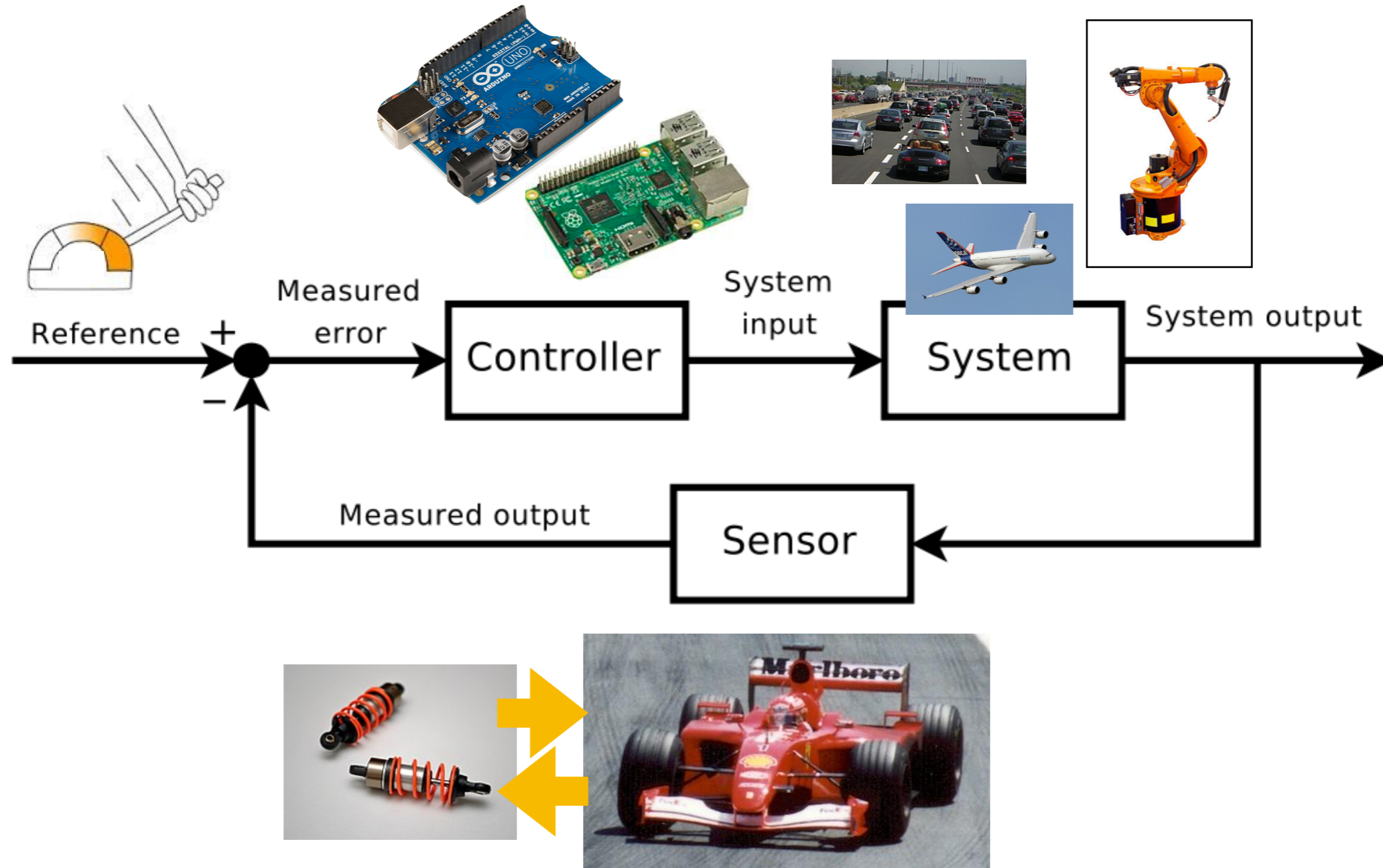
# What is feedback control and what it can do in agriculture

Fulvio Forni

EPSRC CDT Annual Conference

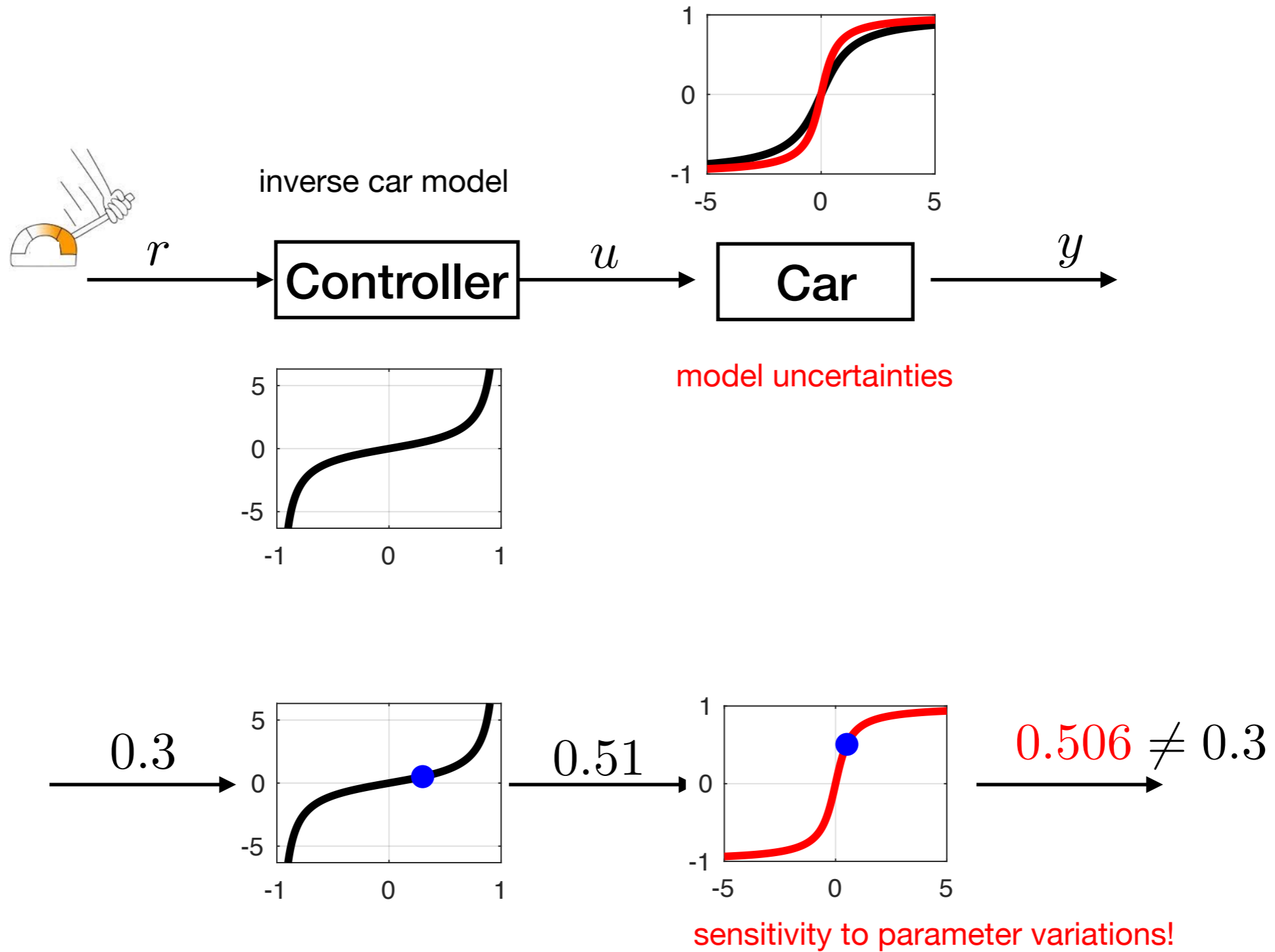


# What is feedback control



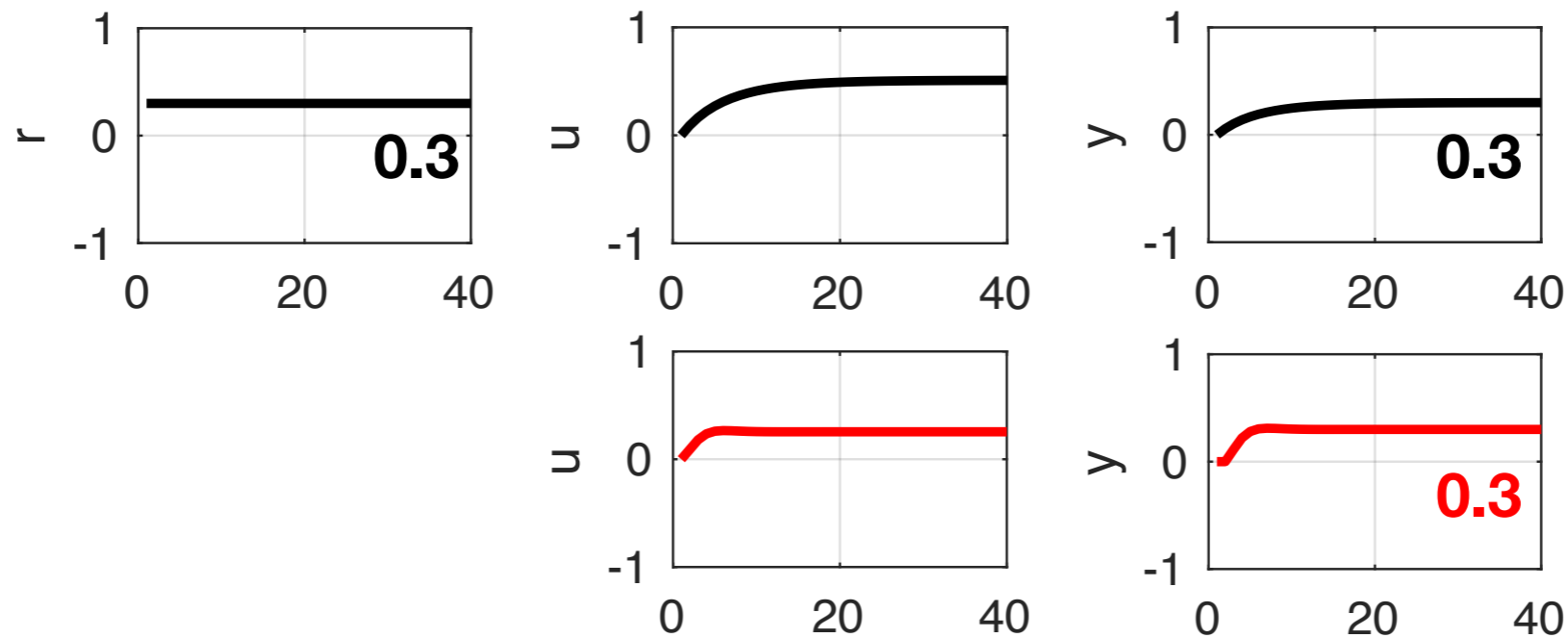
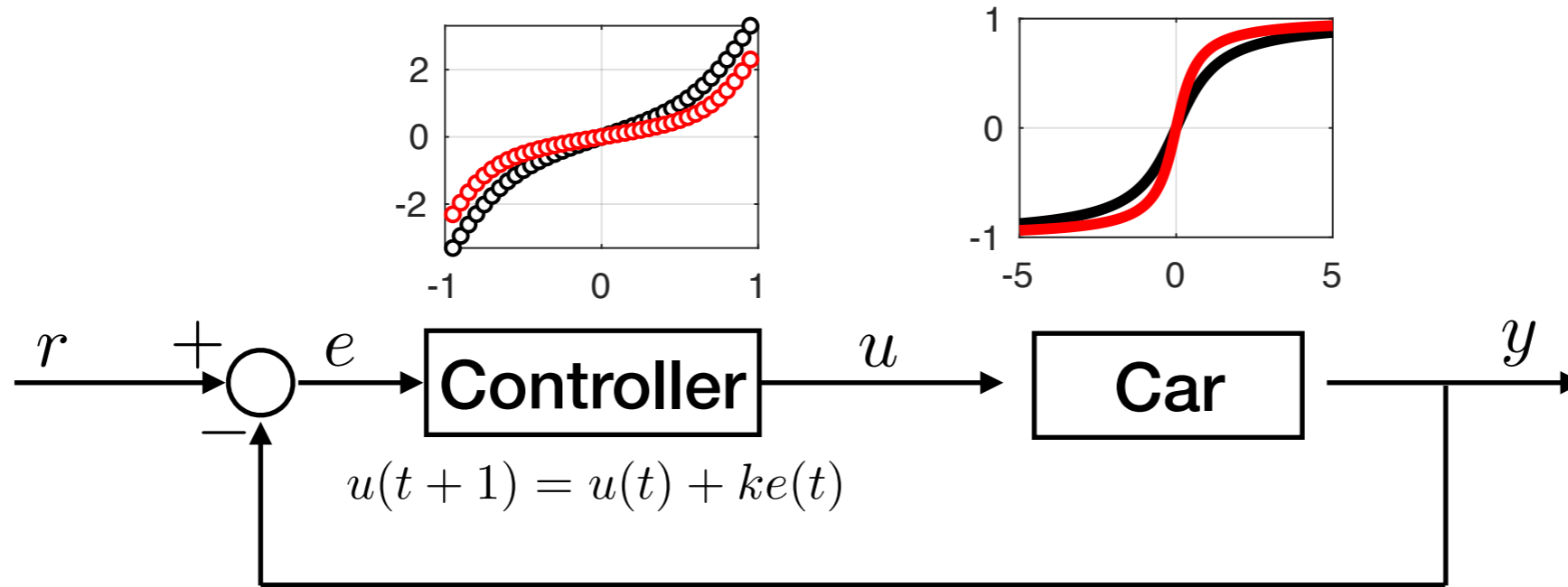
# Why feedback?

# Why feedback? control without feedback is fragile



# Why feedback? feedback for robustness to uncertainties

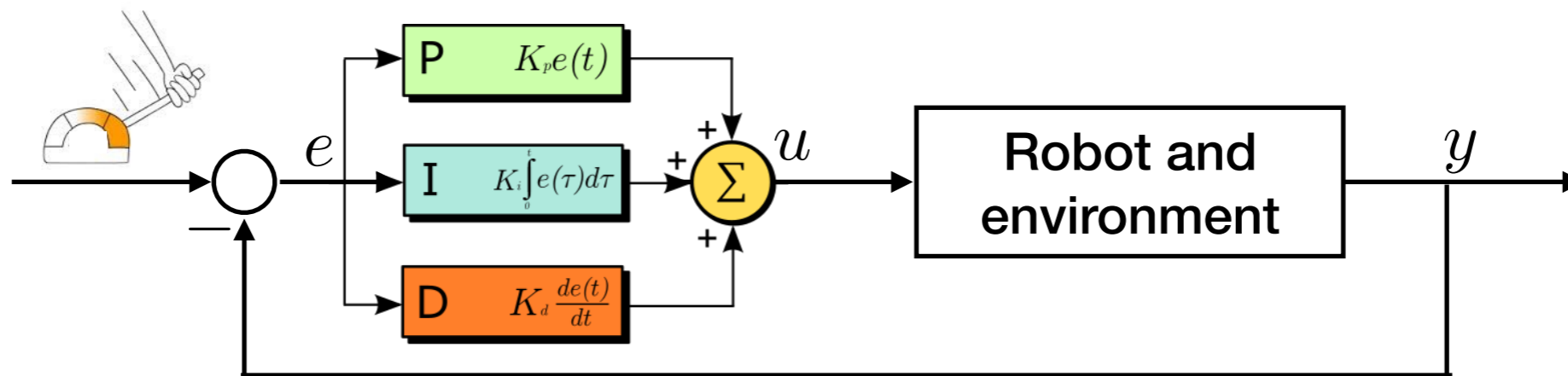
run-time estimation of the inverse model!



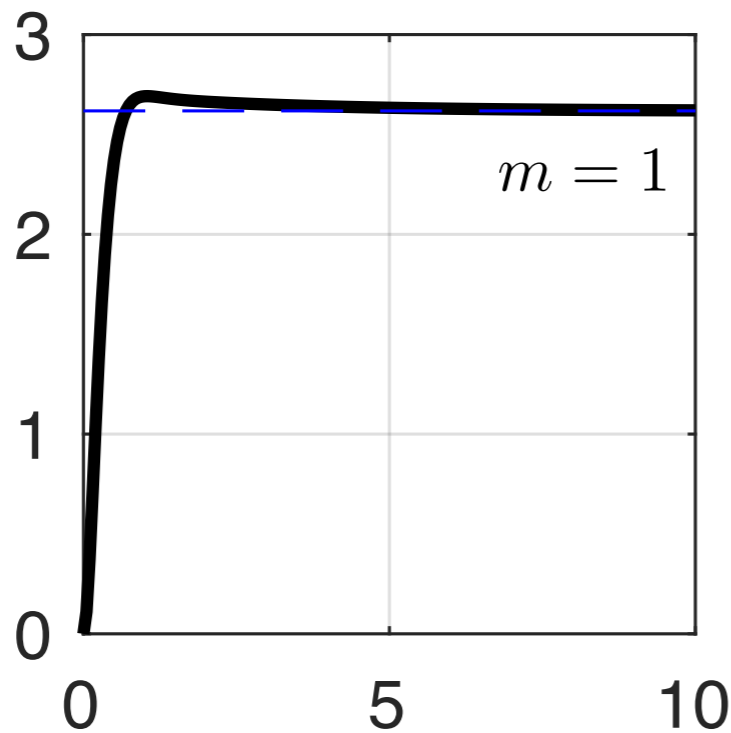
no sensitivity to parameter variations!

# Feedback control of one link robot

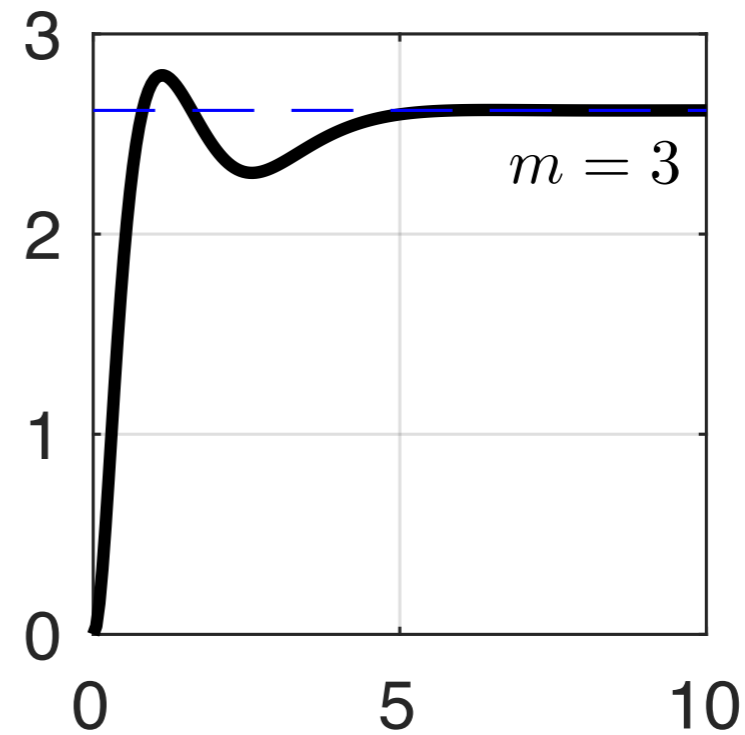
# Feedback control of one link robot



**accurate position control**



**insensitivity to uncertainties**

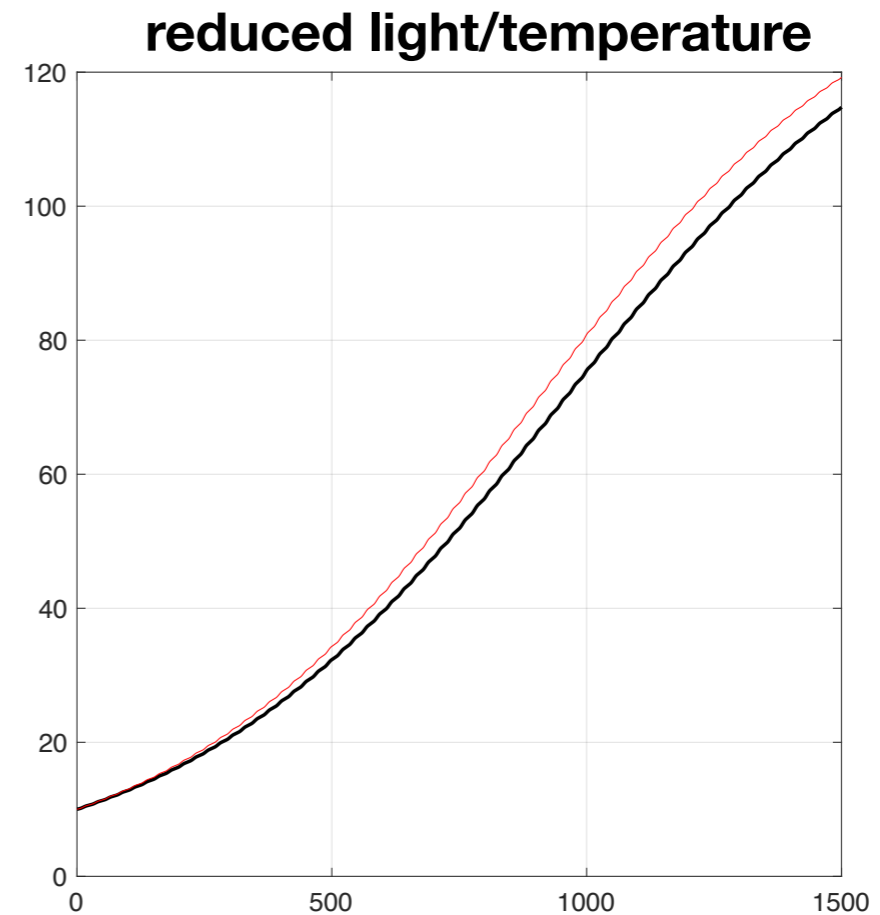
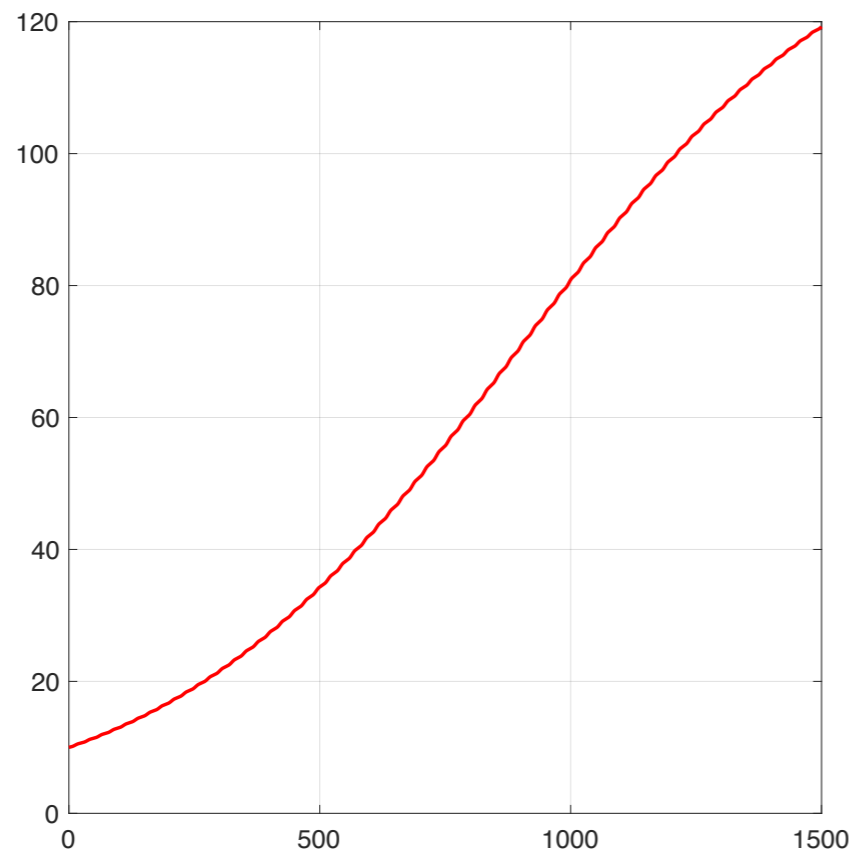
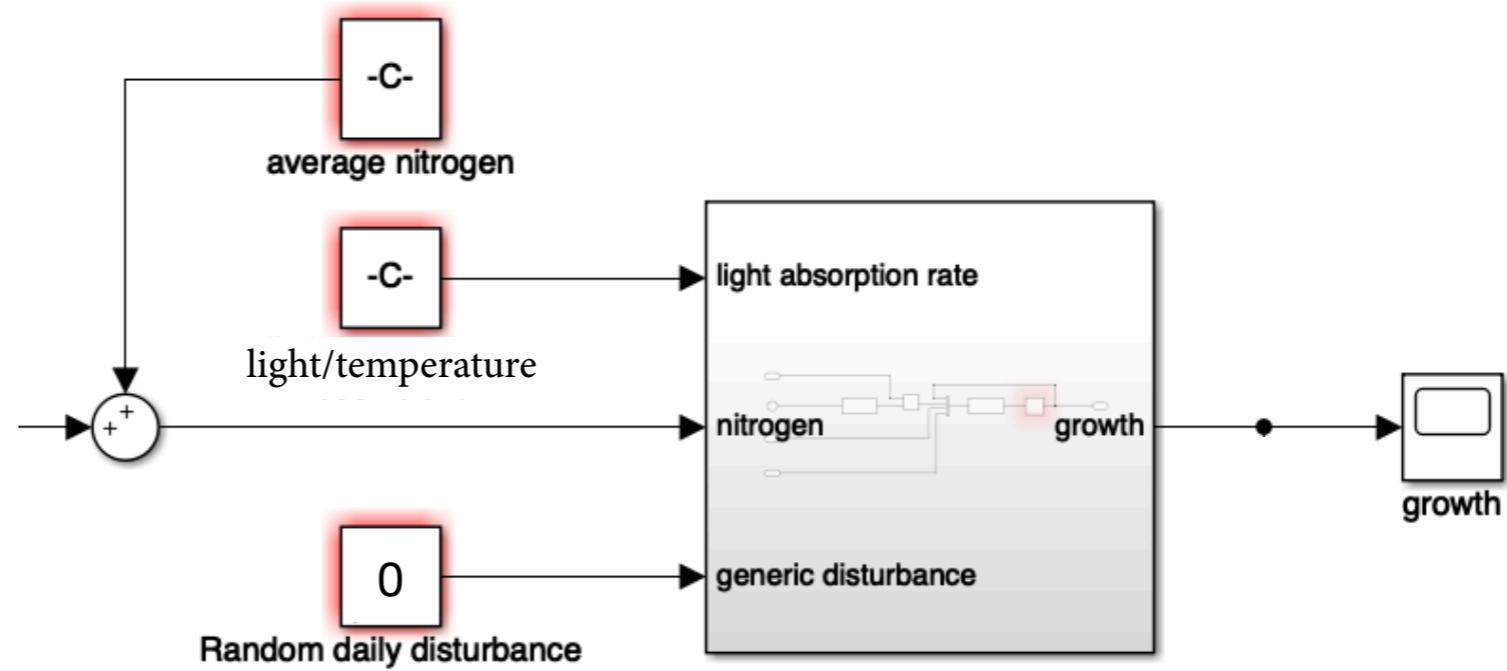


P and D and I... the structure of the controller matters

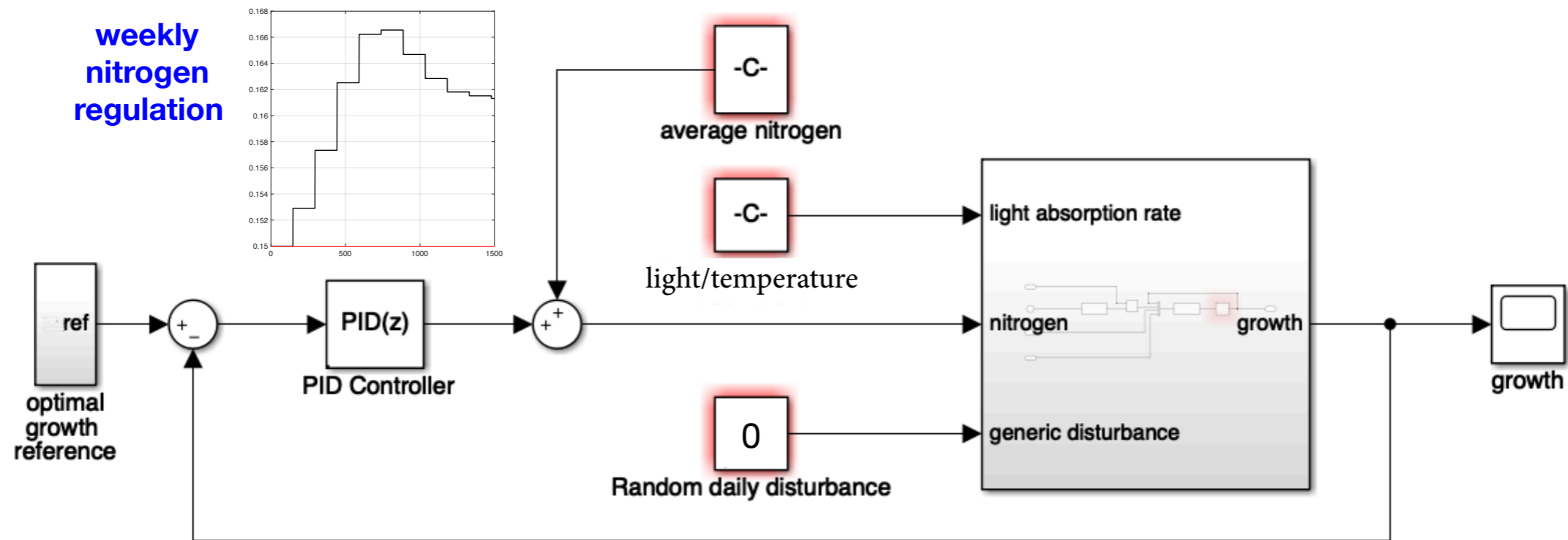
# Feedback control for crop management



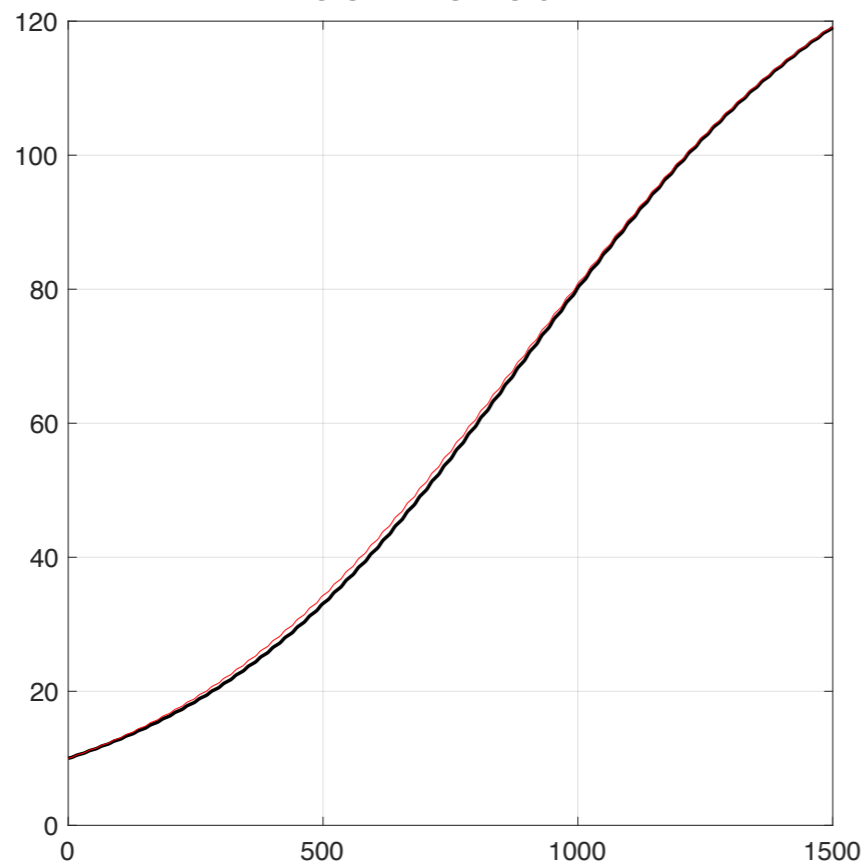
# Feedback control for crop management



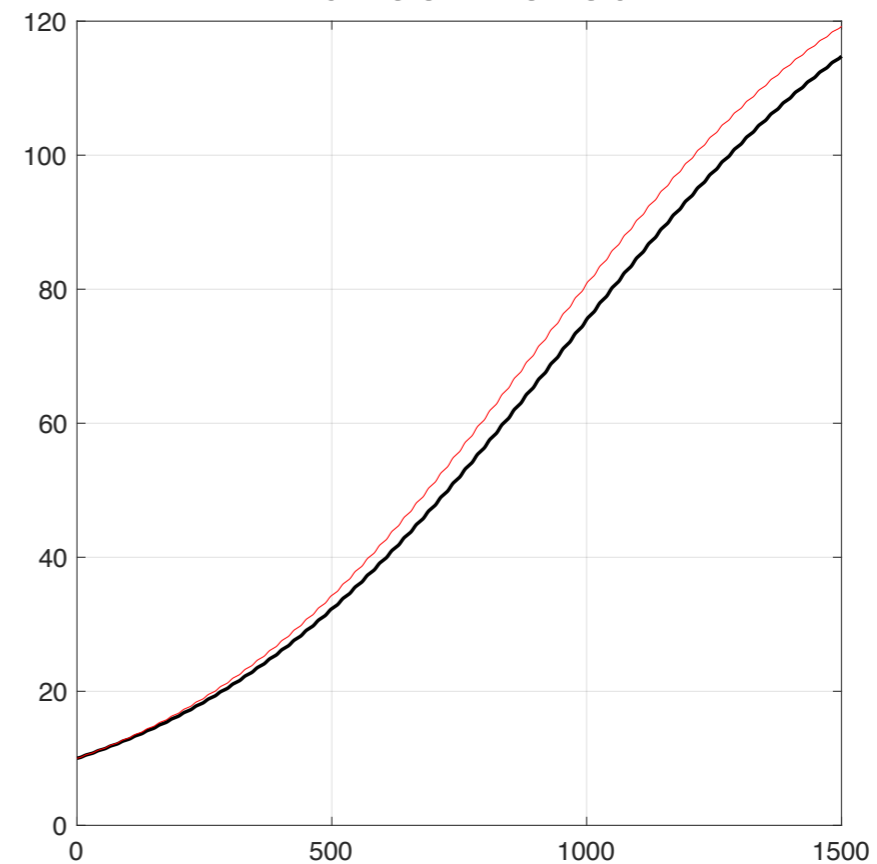
# Feedback control for crop management



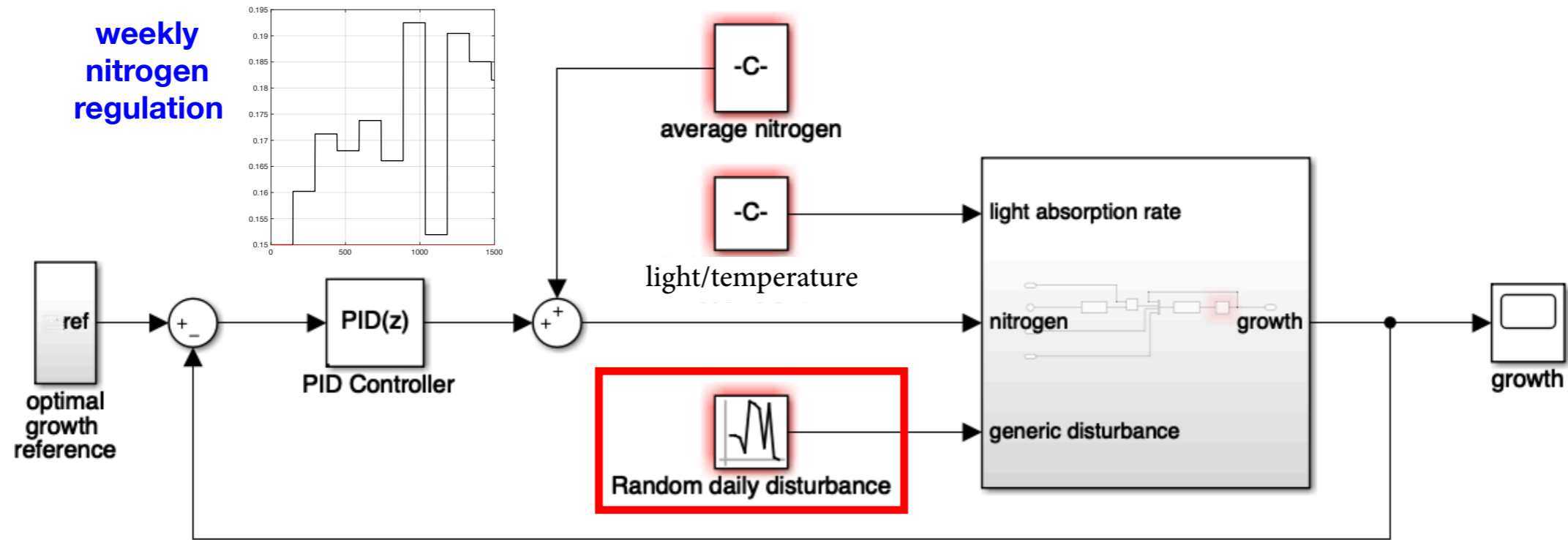
**controlled**



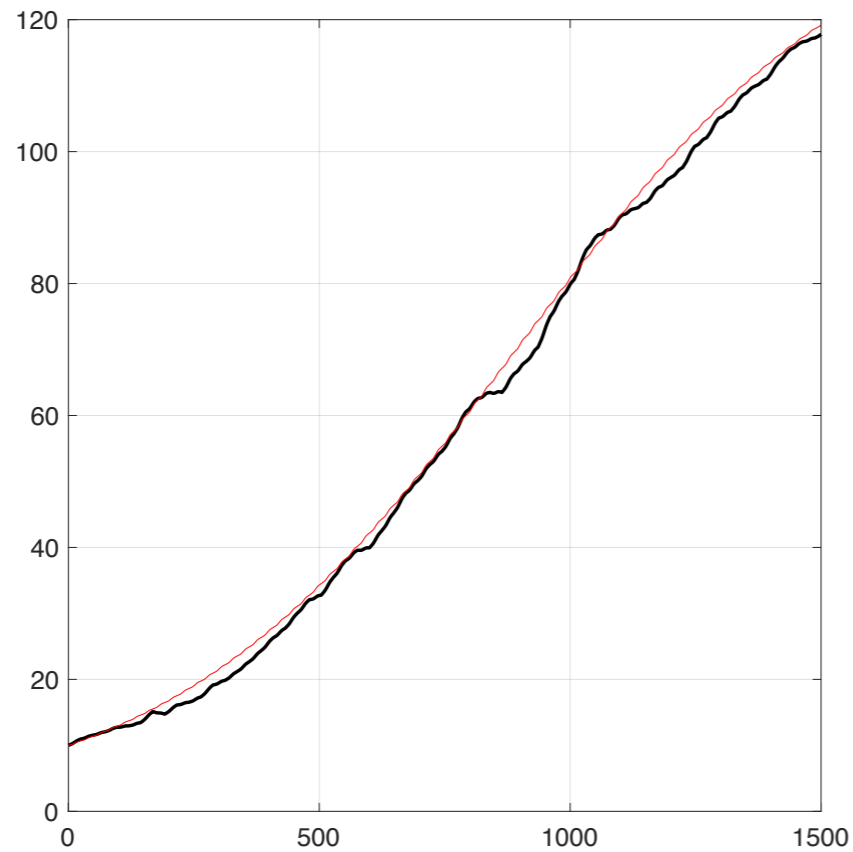
**uncontrolled**



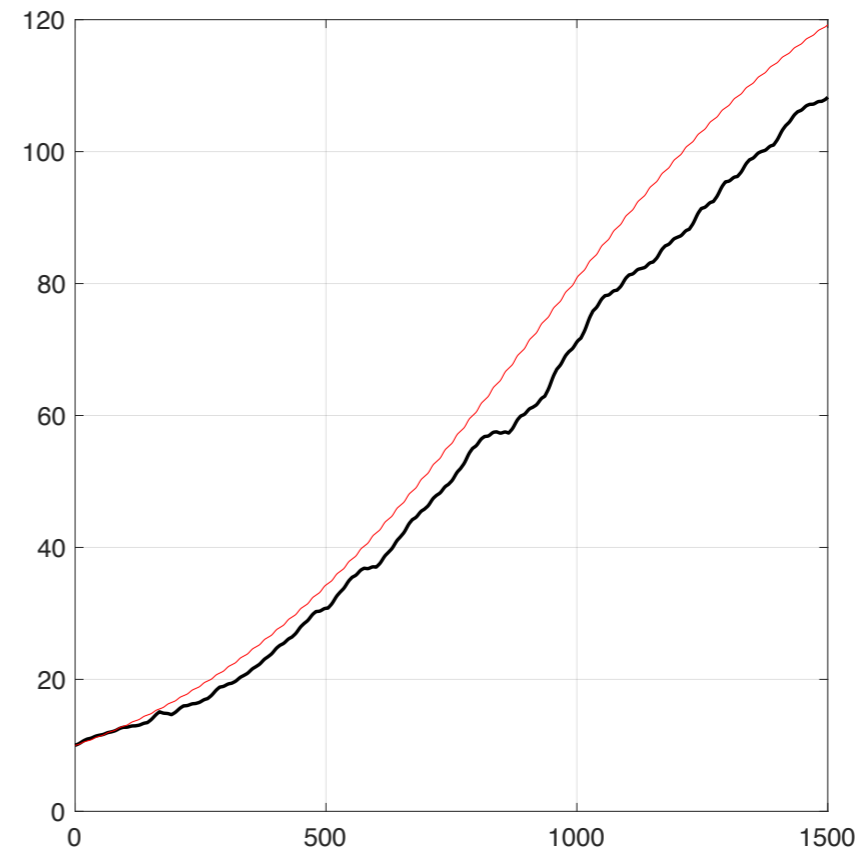
# Feedback control for crop management



**controlled**

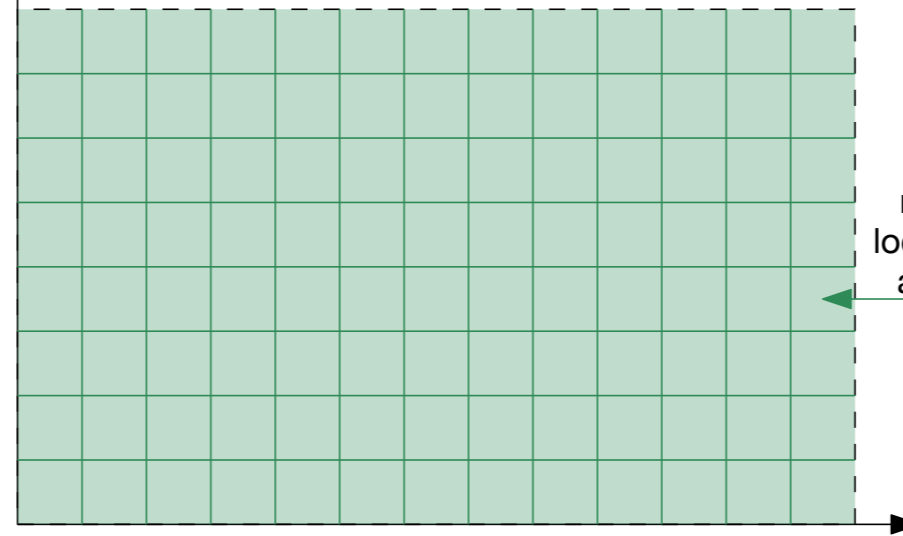


**uncontrolled**



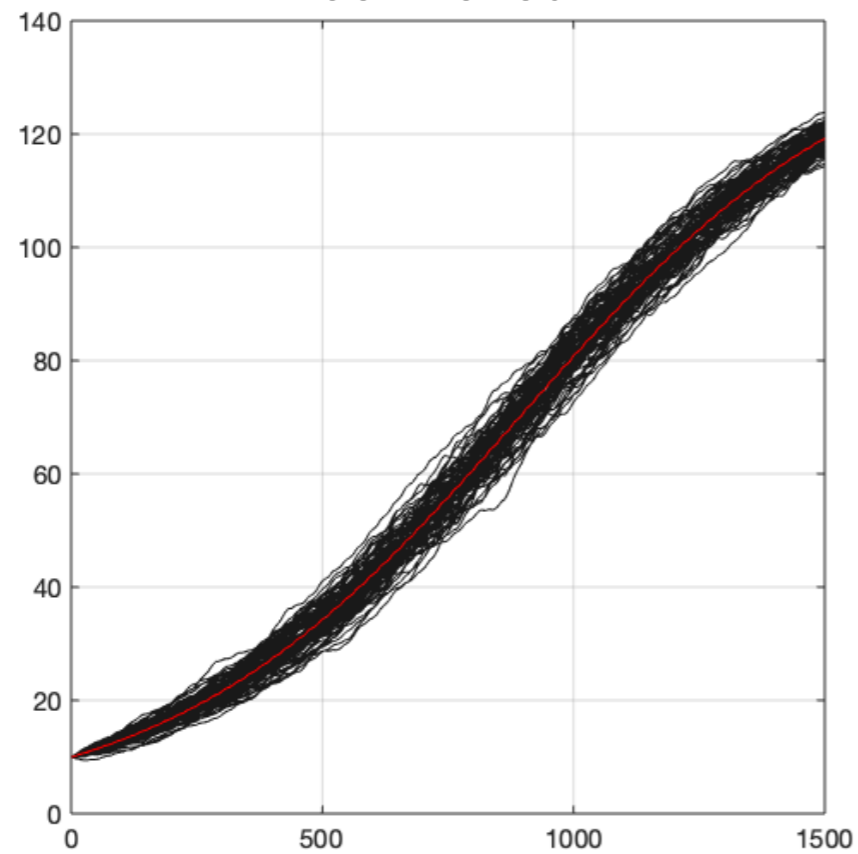
# Feedback control for crop management

↑ non uniform nitrogen control to reduce variance

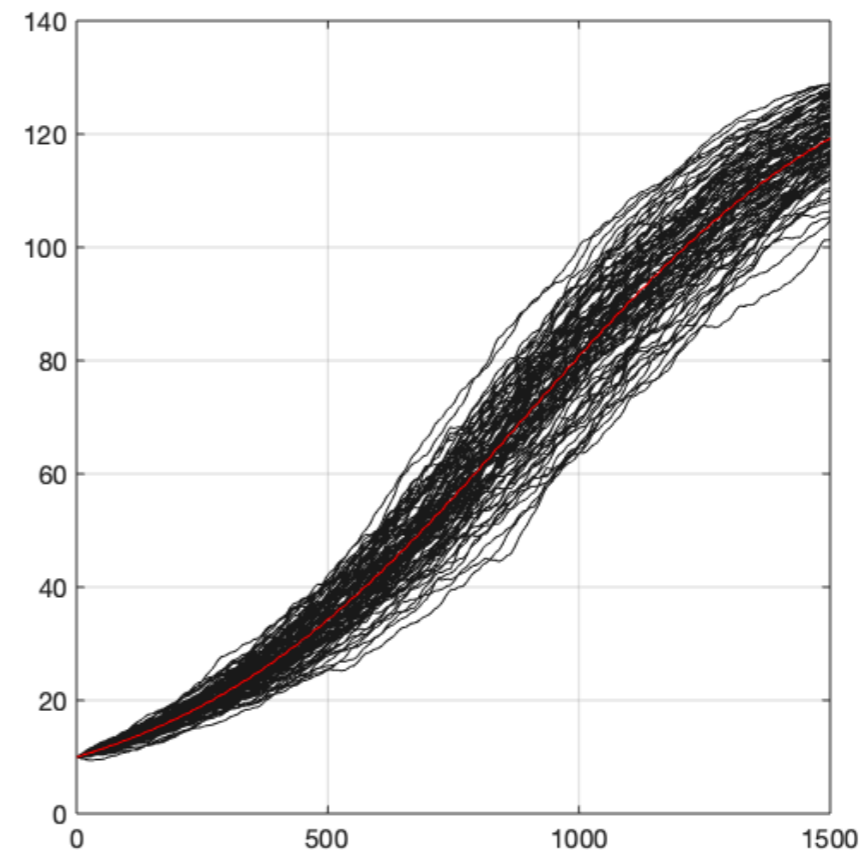


robots deployed for  
local growth estimation  
and nitrogen control

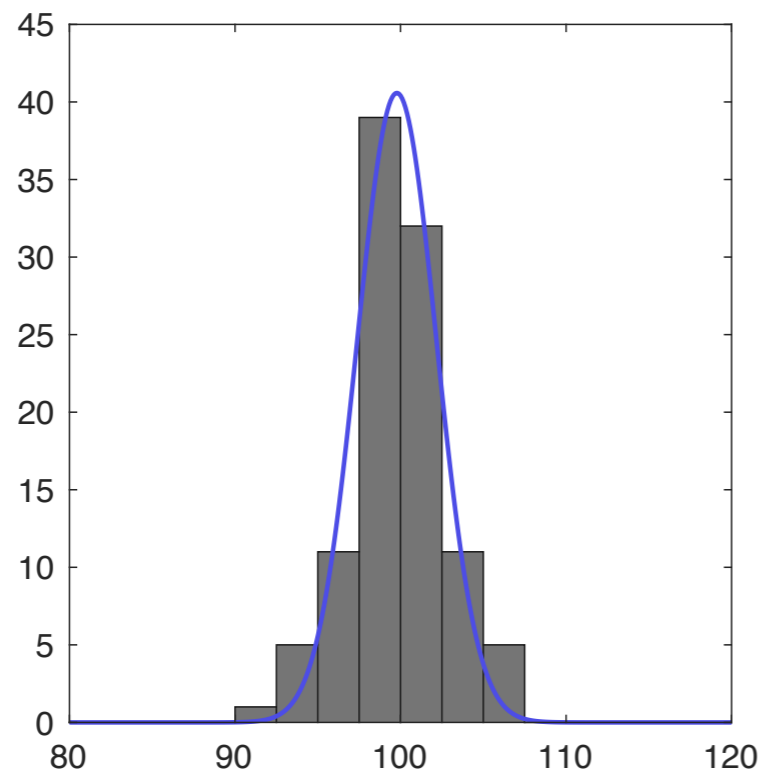
**controlled**



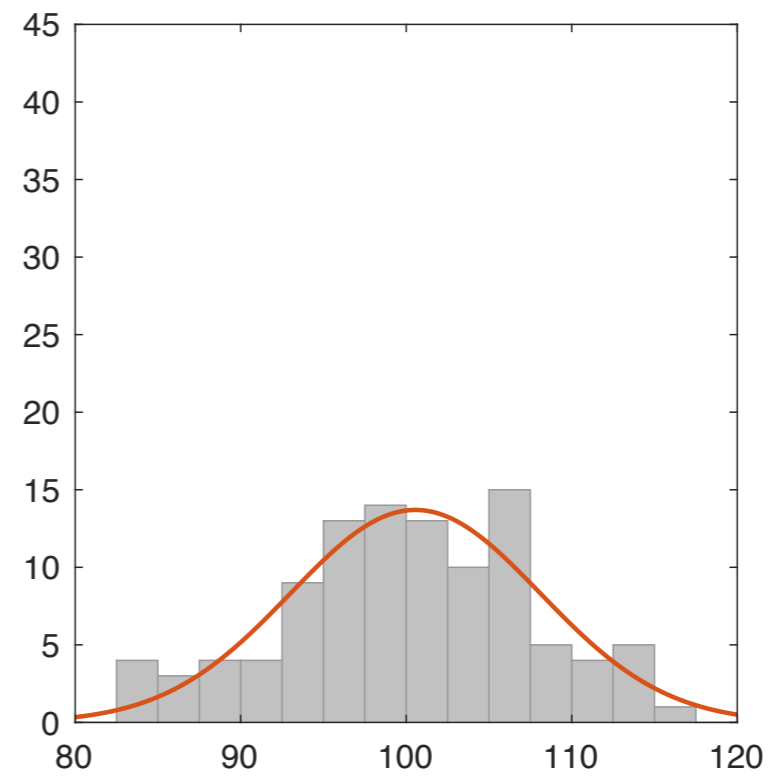
**uncontrolled**



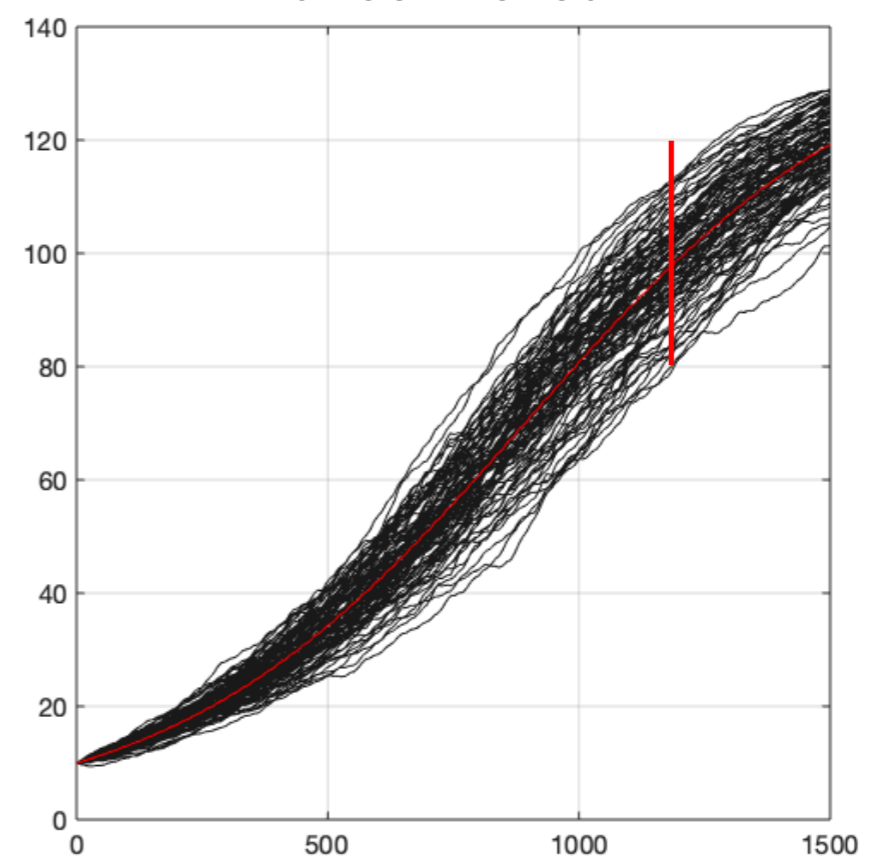
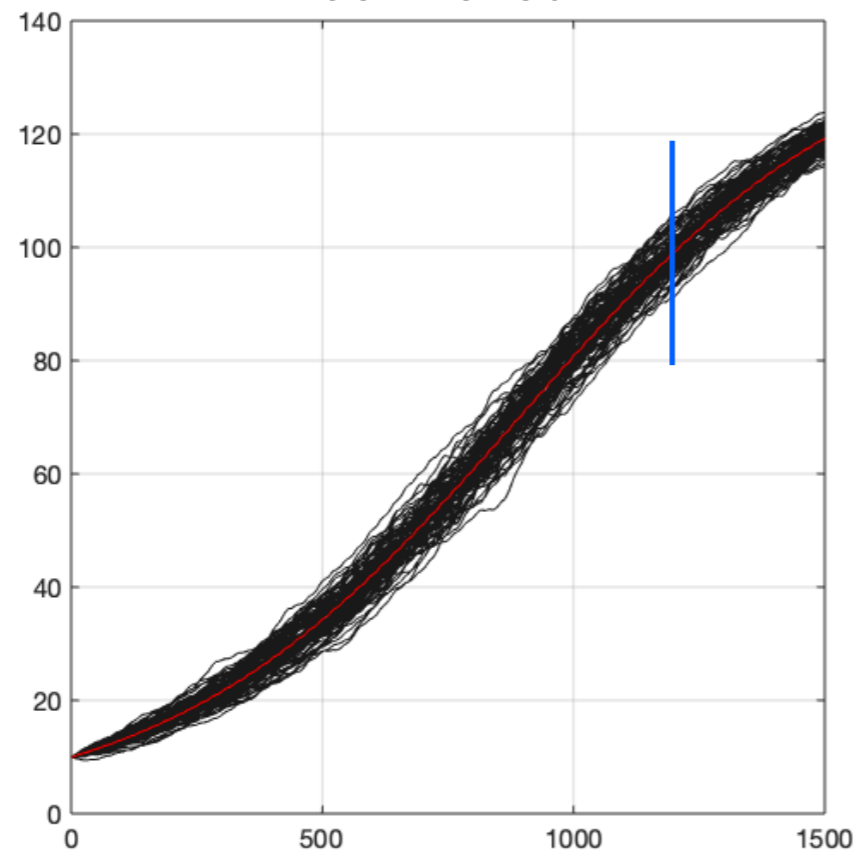
# Feedback control for crop management



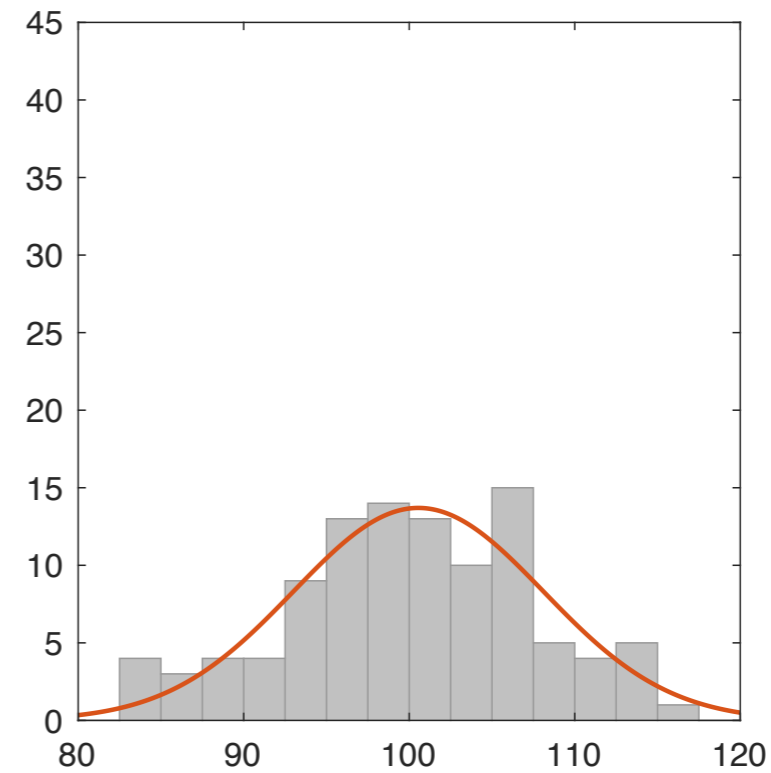
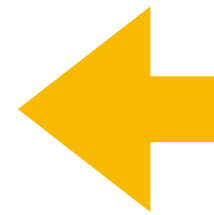
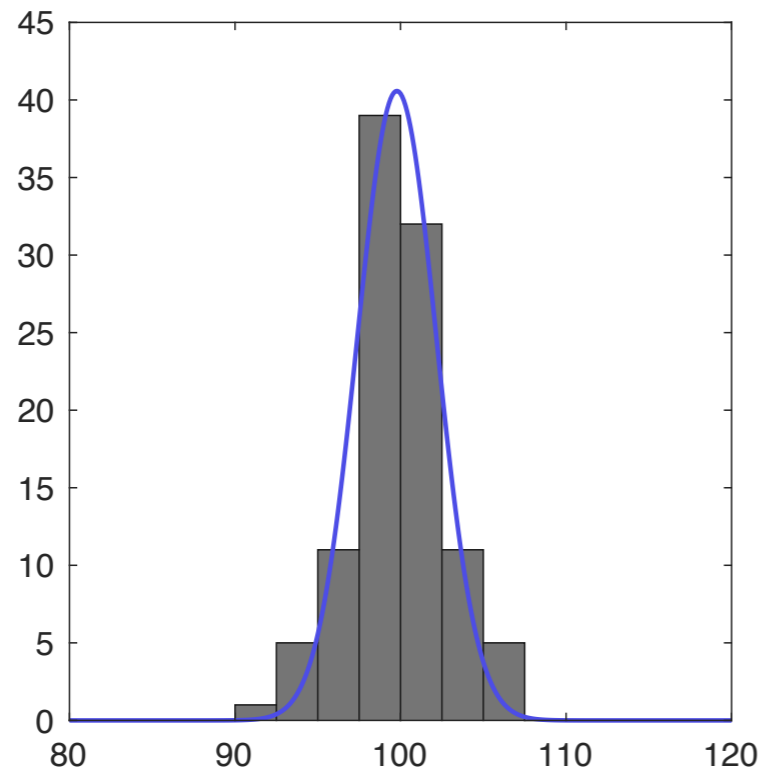
**controlled**



**uncontrolled**



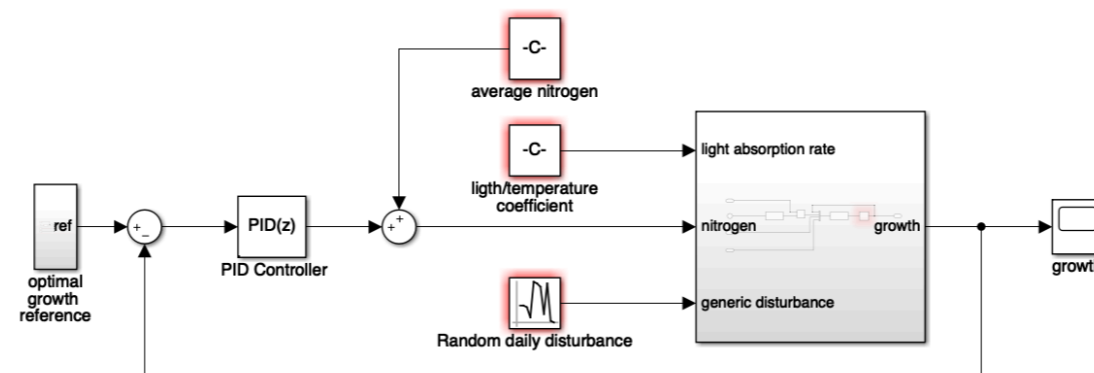
# Feedback control for crop management



**performance optimization**

**robustness to uncertainties**

**low sensitivity to disturbances/noise**



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