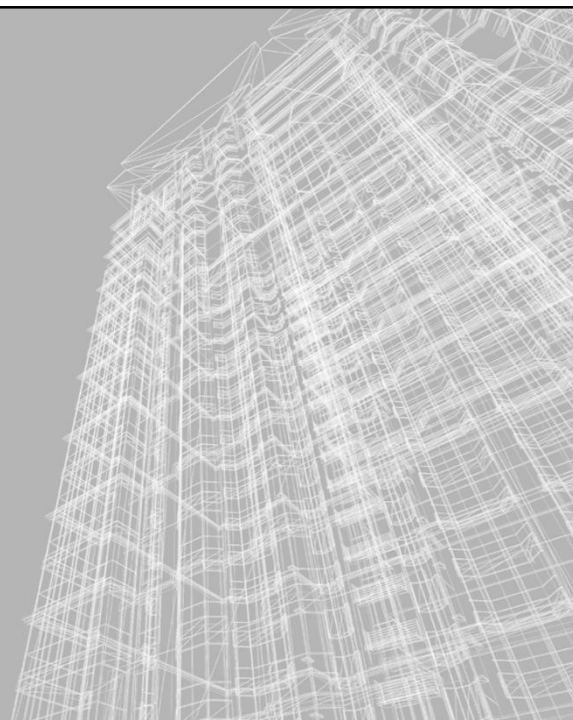


EMPIRICAL MODEL VALIDATION

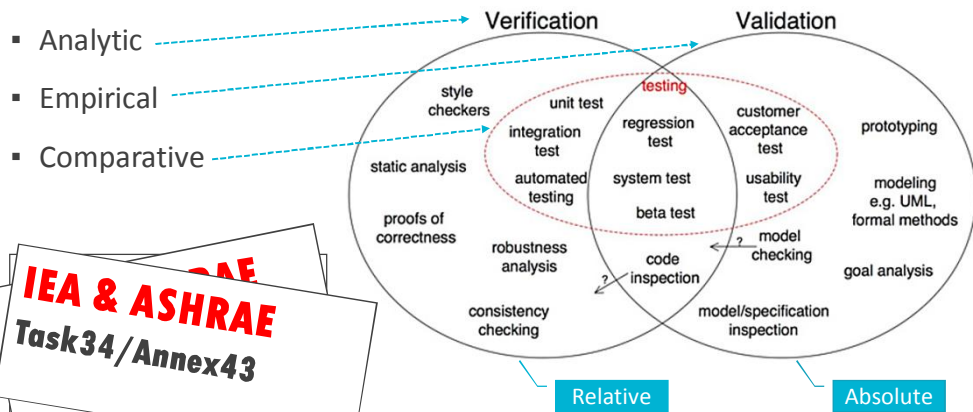
Based On Existing Control System Signals

IBPSA Nordic Q3, 2013

EQUA Solutions AB, Sweden
Marc Azar, marc.azar@equa.se



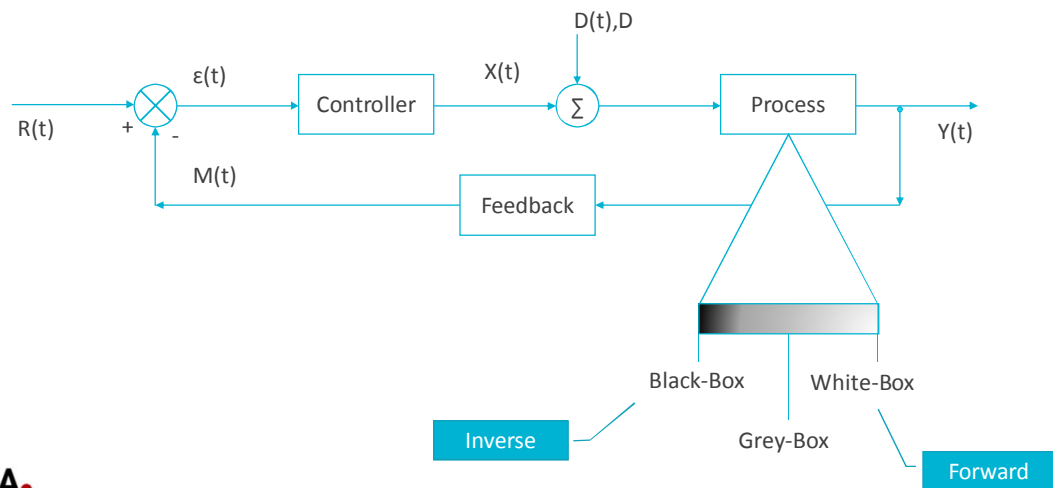
TESTING, VERIFYING, & VALIDATING



*Image from: Professor, Steve Easterbrook, University of Toronto

EMPIRICAL VALIDATION

FIFTY SHADES OF GREY!



3/12 **EQUA.**
SIMULATION TECHNOLOGY GROUP

KISTA ENTRÉ

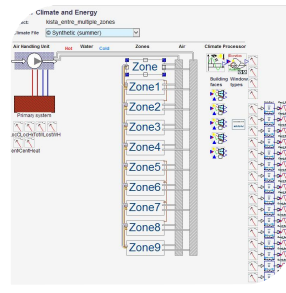
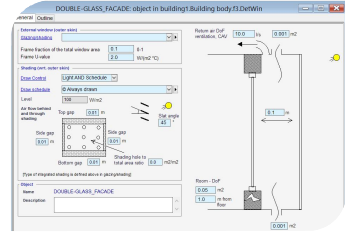
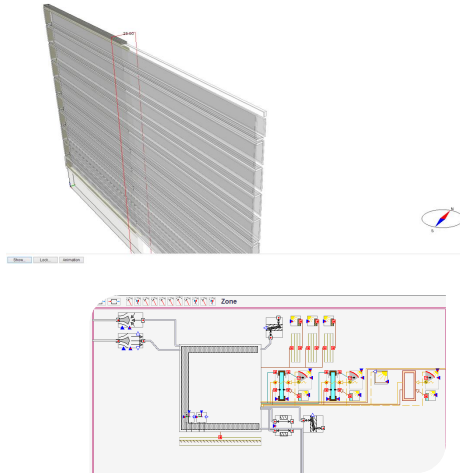
DOUBLE SKIN FACADE



4/12

EQUA.
SIMULATION TECHNOLOGY GROUP

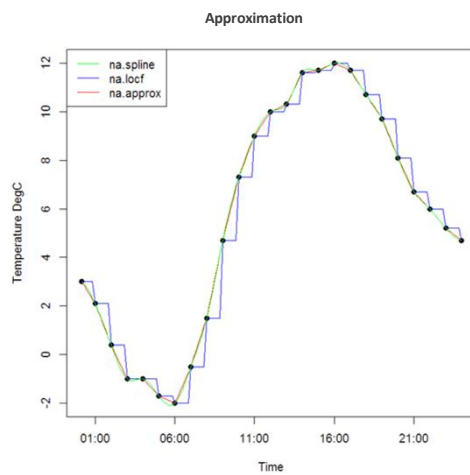
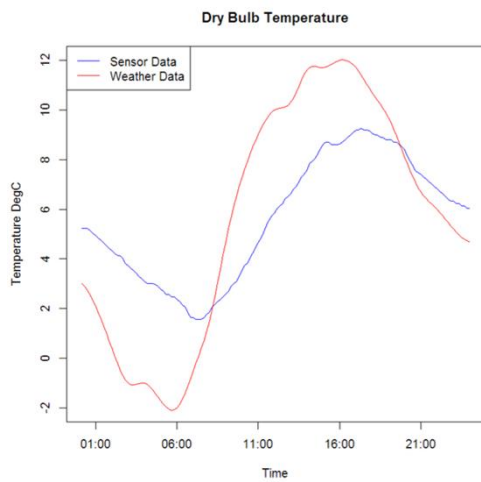
CALIBRATED SIMULATION APPROACH IDA ICE



5/12



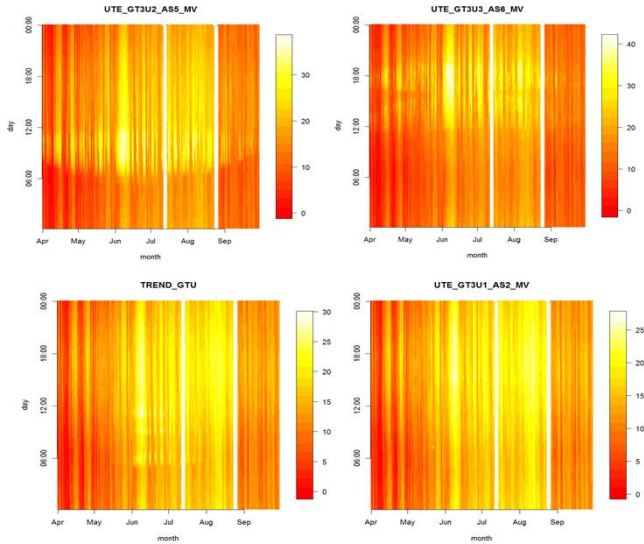
DRIVING DATA



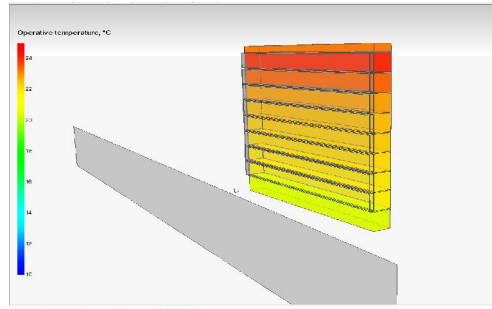
6/12



DRIVING DATA



Carpet plots of dry bulb temperature for different locations on the building

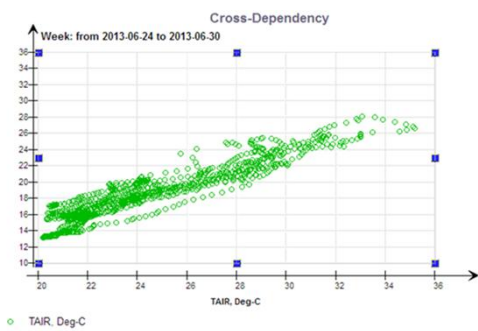


7/12

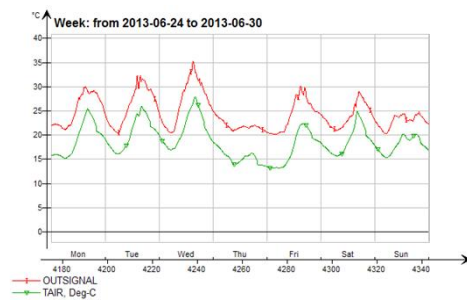


RESULTS

Level 4



Cross correlation between measured DBT and simulated for level 4



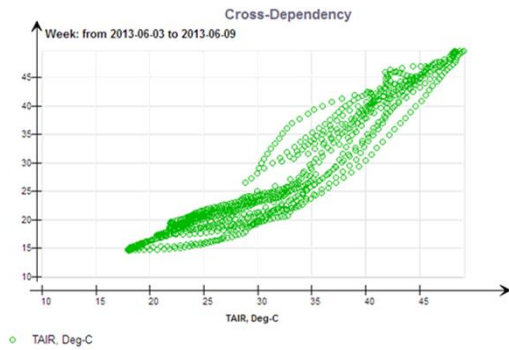
Overlay plot of measured DBT and simulated DBT for level 4

8/12

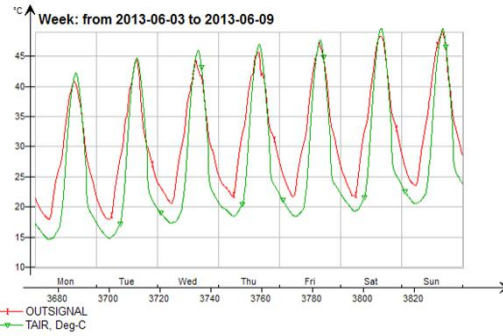


RESULTS

Level 11



Cross correlation between measured DBT and simulated for level 11

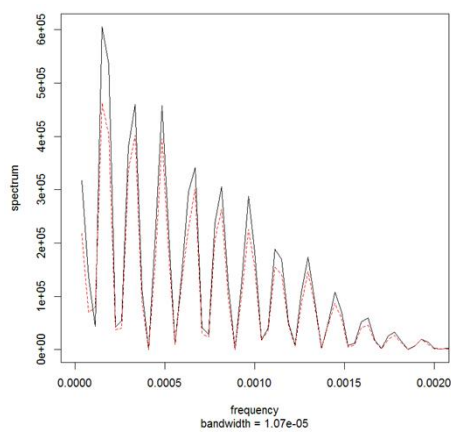


Overlay plot of measured DBT and simulated DBT for level 11

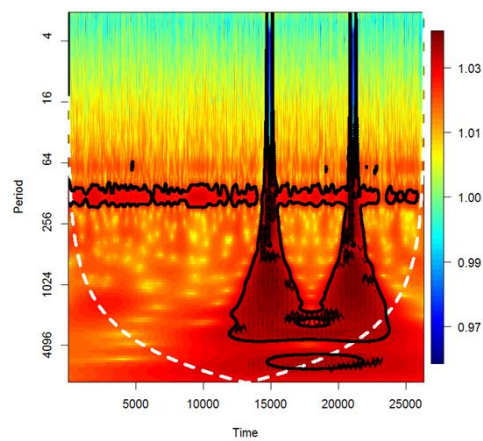
9/12



ANALYSIS



Periodogram of DBT in level 4



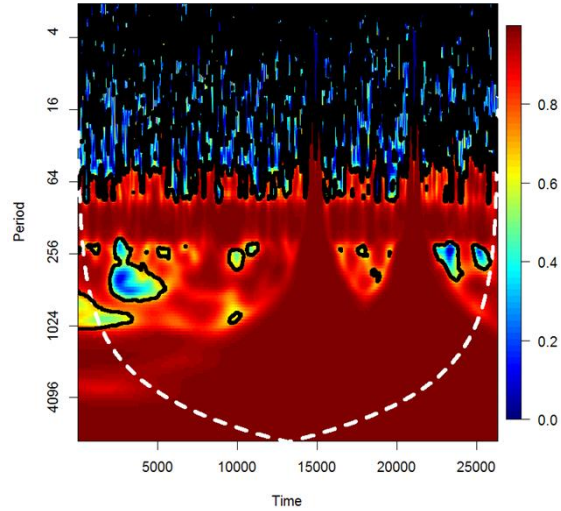
Cross wavelet diagram between measured DBT and simulated DBT in level 4

10/12



ANALYSIS

An overlay of Cross wavelet diagram and coherence wavelet diagram between measured DBT and simulated DBT in level 4.



11/1
2

EQUA.
SIMULATION TECHNOLOGY GROUP



*IBPSA Nordic Seminar
20 September 2013*

EQUA.
SIMULATION TECHNOLOGY GROUP



Thank you!

Any Questions?