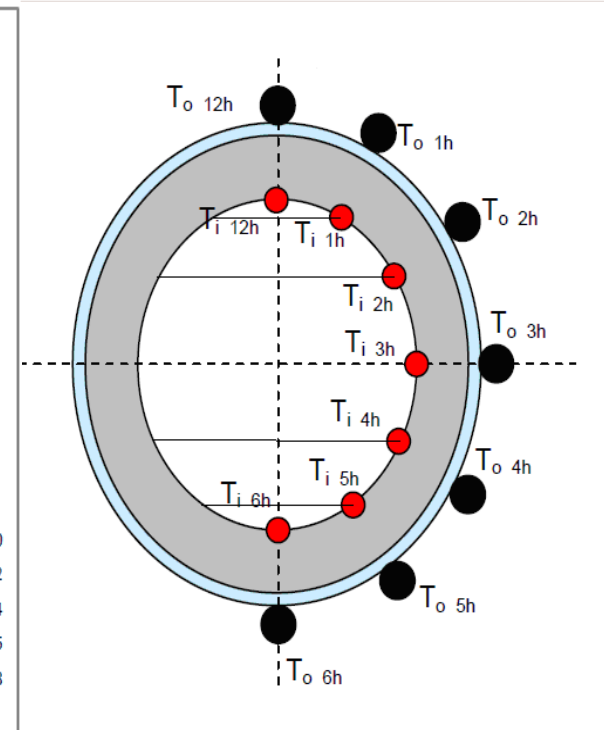
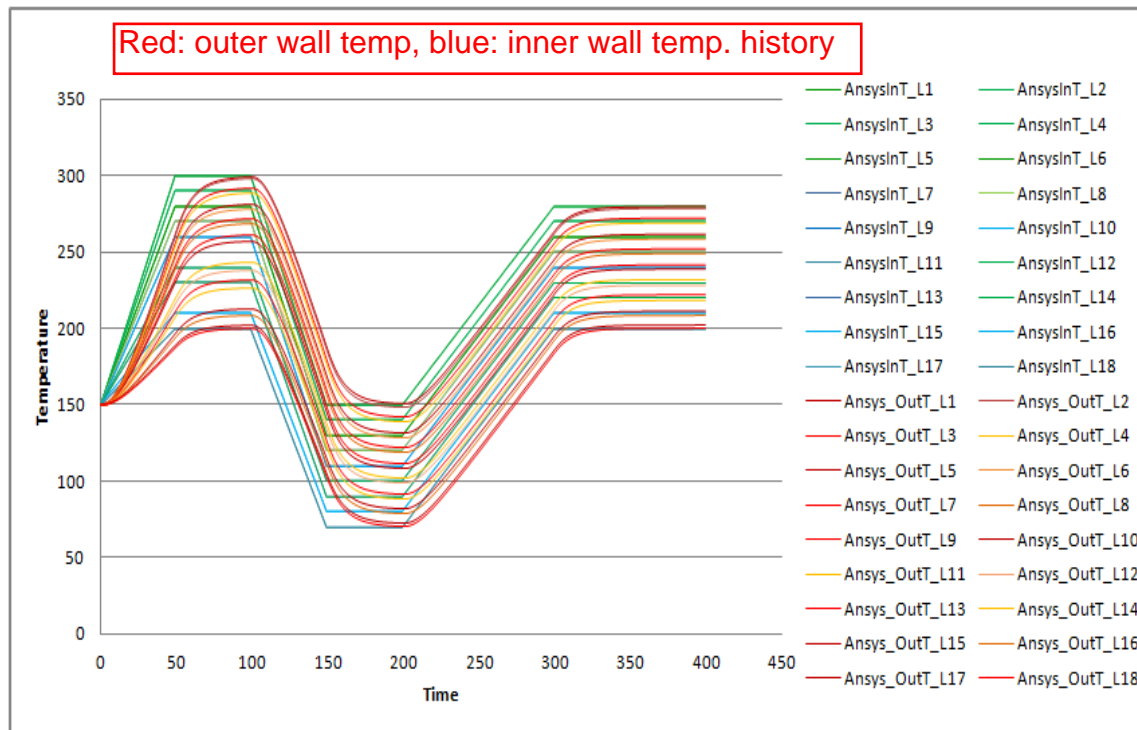


Solution of a typical IHCP

7

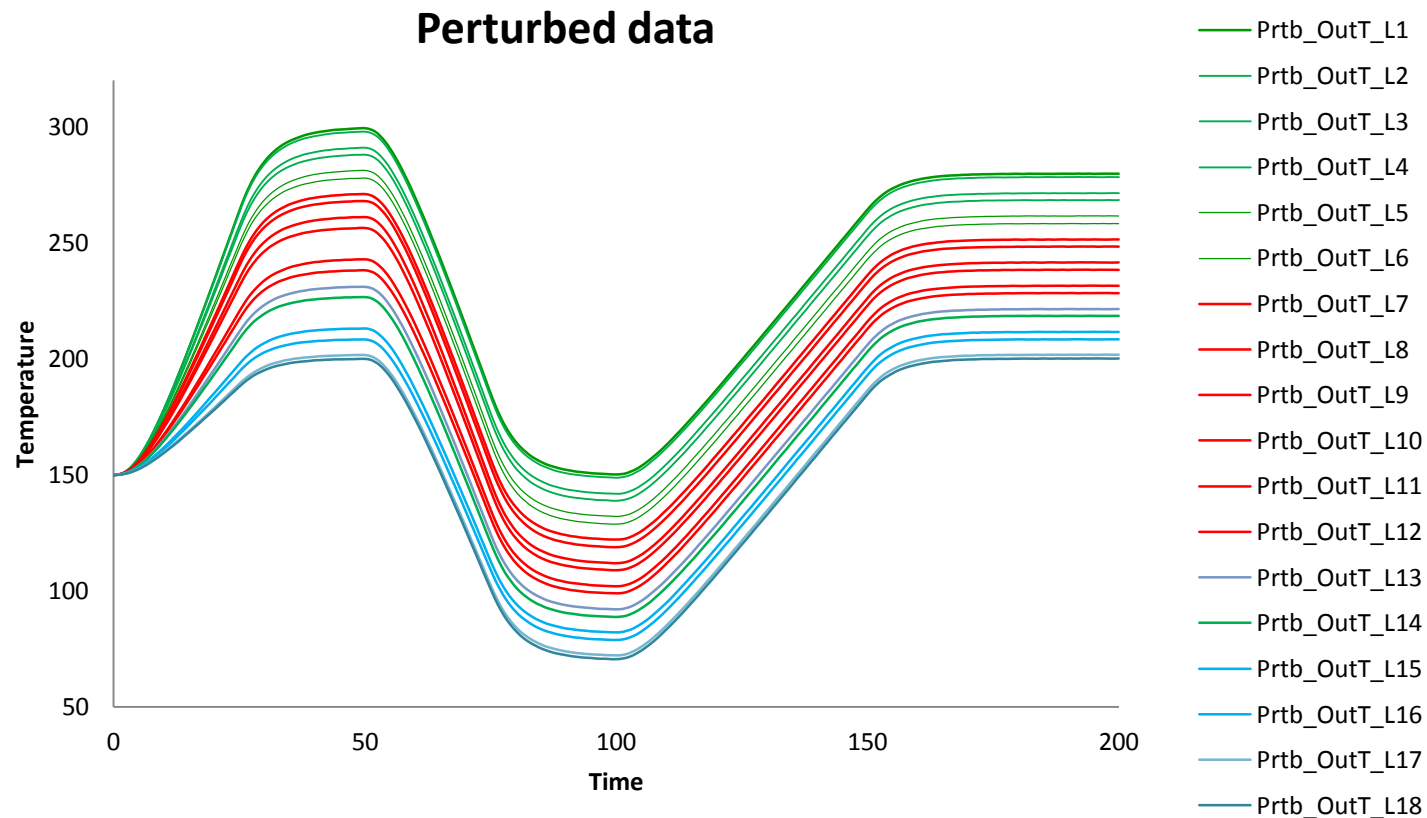


- ❑ boundary value determination inverse problem
- ❑ Very accurate approximation from accurate measured data

Typical problem: Perturbation effect

8

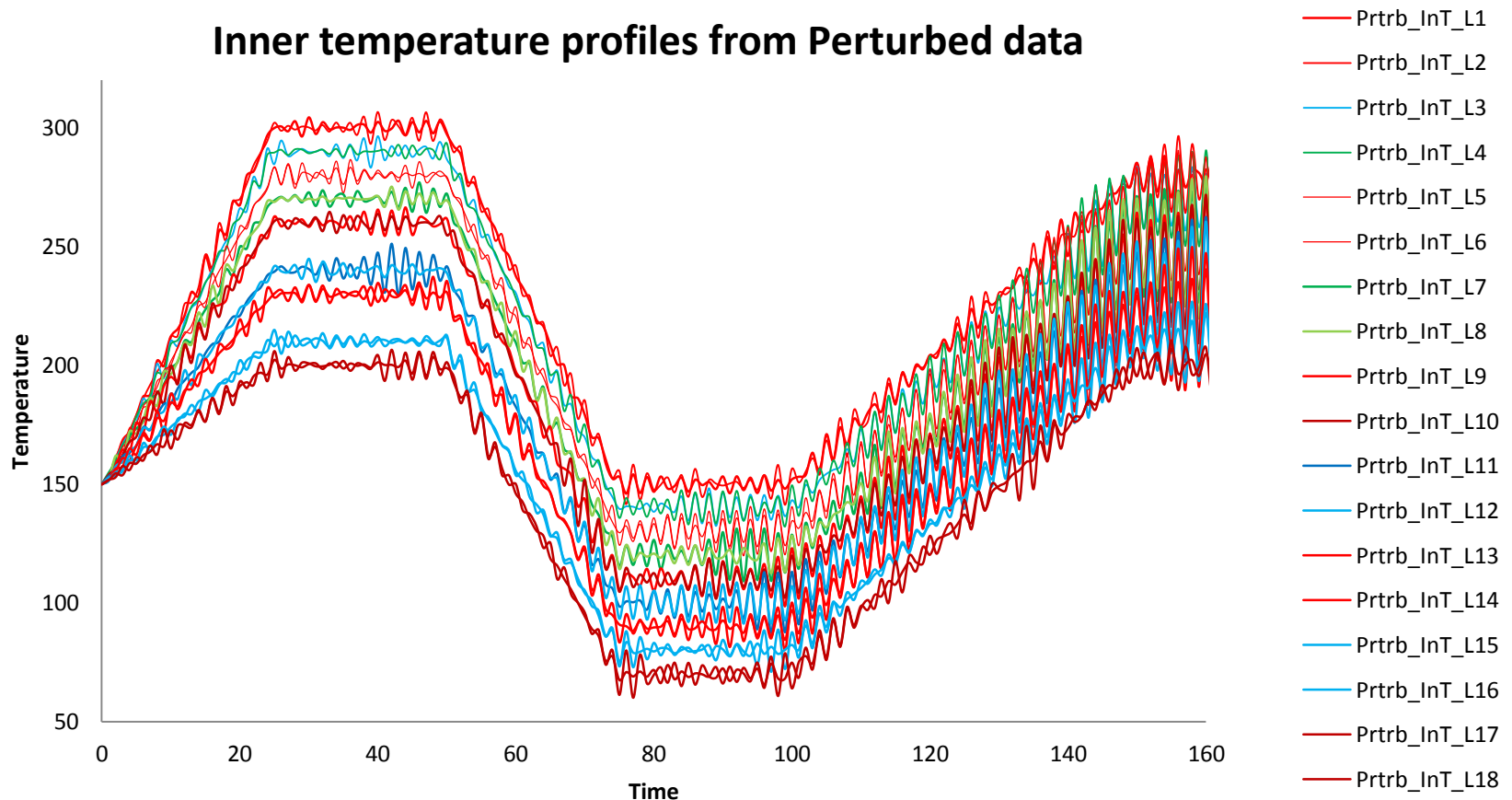
- Random perturbation of $[-0.05, +0.05]$ has been applied



Typical problem: Perturbation effect

9

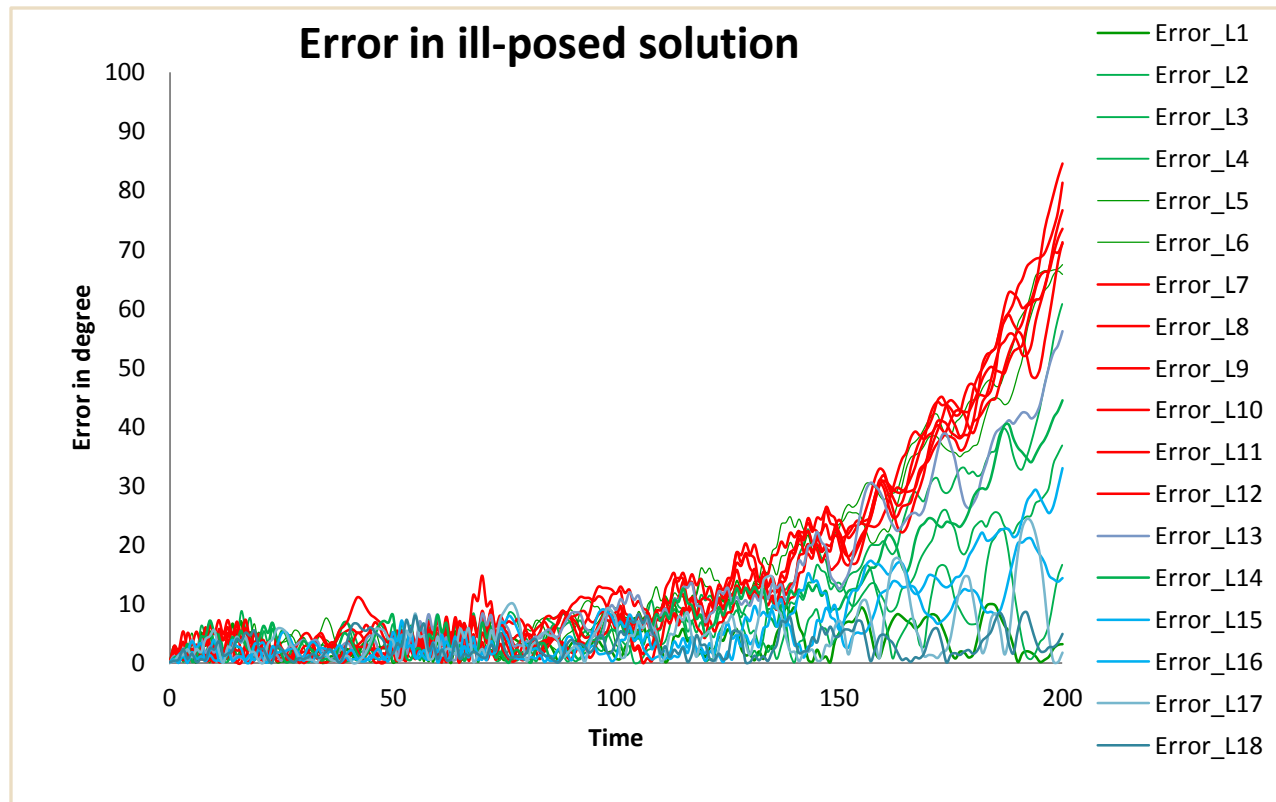
- Perturbation causes error in the solution upto 70/80 degree



Error in the solution from Perturbed data

10

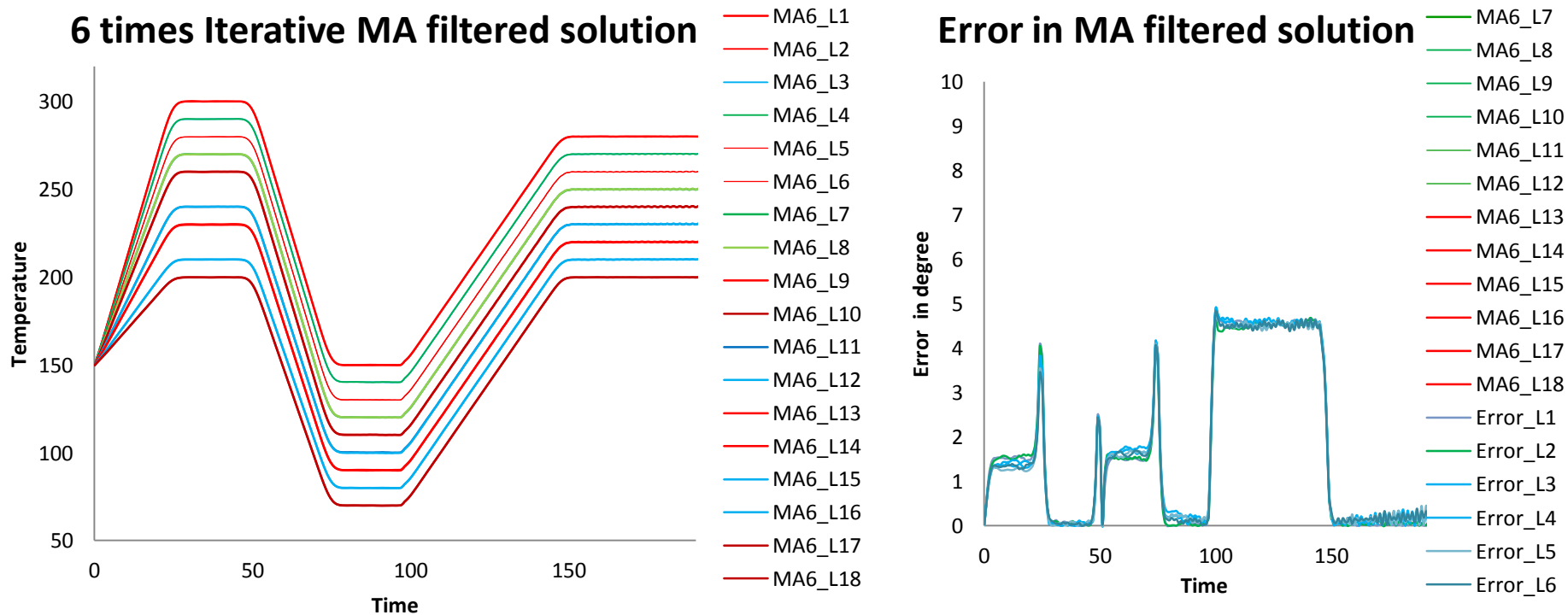
- ❑ Error amount is increasing with computations, as high as 80 degree



Filtering of the Solution: Moving Average

11

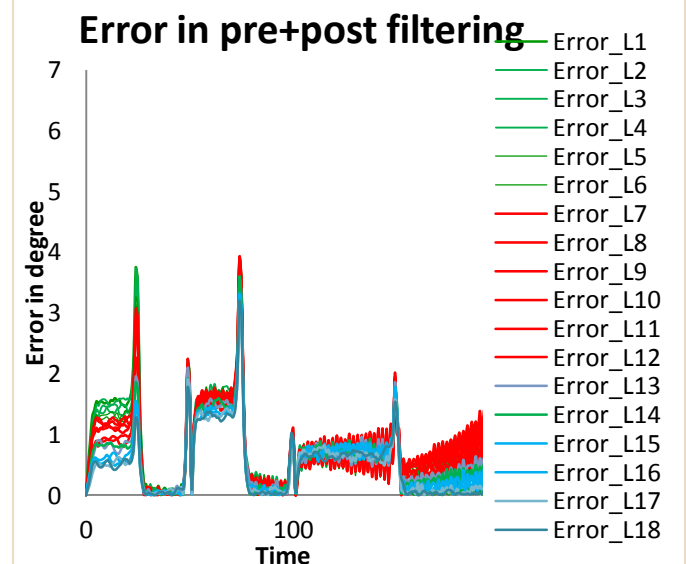
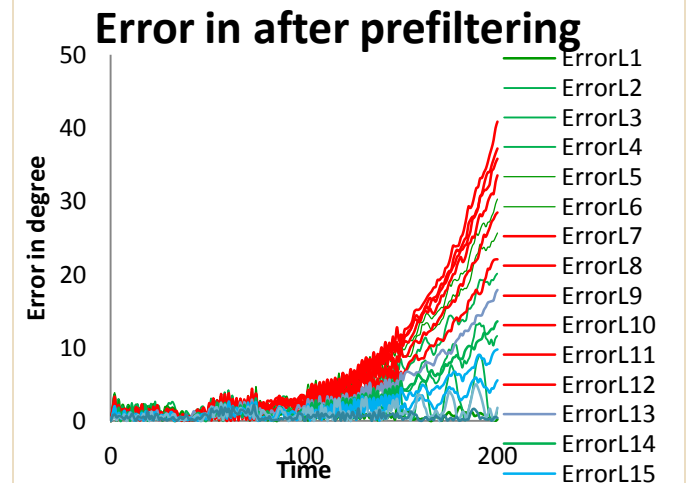
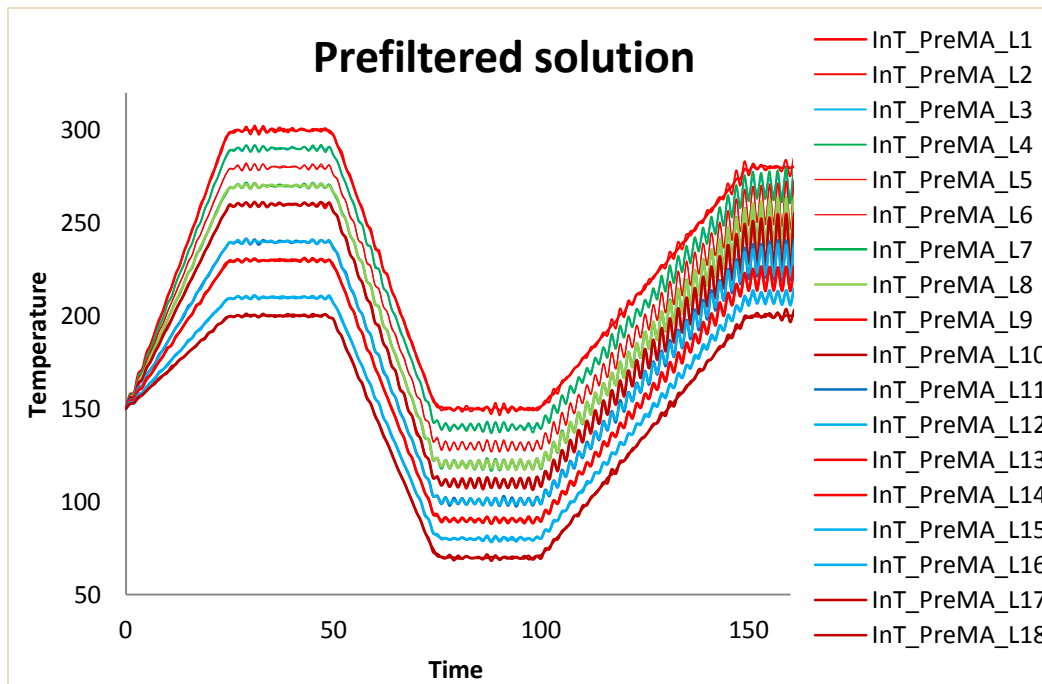
- ❑ Moving Average Filter, simplest one: $y[i] = \frac{1}{M} \sum_{j=0}^{M-1} x[i+j]$
- ❑ Sixth times iterative MA filtering force the error below 5 degree



Pre- and Post filtering Effect

12

- Third time iterative MA filtering results error < 4 degree



Kalman Filter

13

- Optimal estimator of a **state**, Recursive Data Processing Algorithm
- Determination of planet orbit, Satellite navigation system, Dynamic positioning, Ensemble KF in fluid flow estimation through heterogeneous rock
- Tracking targets - eg aircraft, missiles using RADAR

The diagram illustrates the Kalman Filter update equation with the following components and annotations:

- Equation:**
$$\hat{X}_k = K_k \cdot Z_k + (1 - K_k) \cdot \hat{X}_{k-1}$$
- Annotations:**
 - current estimation:** Points to \hat{X}_k .
 - measured value:** Points to Z_k .
 - Kalman Gain:** Points to K_k .
 - previous estimation:** Points to \hat{X}_{k-1} .
- Formula for Kalman Gain:**
$$K_k = \frac{\sigma_{z_1}^2}{\sigma_{z_1}^2 + \sigma_{z_2}^2}$$

Effect of Kalman Filtering

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- Second iterative Kalman Filtering results < 3 degree

