ABSTRACT
In combinations of AFs, the component filters usually run independently to be later on combined, leading to a stagnation before reaching the lower error. Conditional transfers of coefficients between the components have been introduced to address this issue. This work proposes a more natural way of accelerating convergence, using cyclic feedbacks of the overall weights to the components instead of unidirectional conditional transfers. It is shown that the cycle length can turn the resulting recursion into an independent combination, a variable step size AF or a hybrid algorithm. Comments on the universality of the approach are presented along with a technique to design the cycle length. Comparisons in different system identification scenarios show the superior performance of the new method.

INTRODUCTION
Combination of adaptive filters Used when accurate design of a single filter is difficult (e.g., improve the transient/steady-state trade off)
Definition: set of independent AFs combined by a mixing parameter Problem: convergence stagnation Possible solutions: Different structures (incremental-cooperative) and conditional transfers of coefficients.

THE STAGNATION PROBLEM
Adaptive filters
\[ w_{n+1} = w_{n+1} + w_n d_n \]
Combination of adaptive filters
\[ w_{n+1} = \sum_{i=1}^{N} \lambda_i(t) w_{n,i+1} \]

CYCLIC COEFFICIENTS FEEDBACK
\[ \lambda_i(t) = \alpha_i(t) \left( \delta(t) - \lambda_i(t) \right) + \mu_i \varepsilon_i(t) \]
\[ a_i(t) = a_i(t) \left( \delta(t) - \lambda_i(t) \right) + \mu_i \varepsilon_i(t) \]
\[ w_{n,i+1} = \delta(t) - \lambda_i(t) w_{n,i+1} + (1 - \delta(t)) w_{n,i} \]
\[ w_{n,i+1} = w_{n,i+1} + \mu_i \varepsilon_i(t) \]

A BRIEF ON ANALYSIS
The cycle length effect
\[ VSS \quad CLMS \]
\[ L \quad \infty \]

SIMULATIONS
Model validation
Experimental setup

CONCLUSION
A novel scheme to overcome the stagnation problem of parallel-independent combinations was proposed: the cyclic coefficients feedback;
The solution is more natural than conditional transfers of weights;
For two LMS filters, the structure is equivalent to a CLMS, a VSS algorithm or a hybrid AF, depending on the cycle length;
A method to design the cycle length was developed and validated;
Simulations showed that the new algorithm can either match or outperform CLMS, transfer of coefficients and series topology under different scenarios.

I. should be chosen where the model lines cross