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# A MIMO AAA algorithm for frequency dependent line modeling

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# Background

- Vector fitting is the current industry standard for MIMO Rational Approximations
  - We extended the AAA algorithm to MIMO systems
  - AAA is a powerful and fast greedy algorithm for constructing rational approximations in barycentric form from samples of a function
  - Improvement in accuracy of these approximations will improve accuracy of EMT simulations
  - Reduction of the number of approximation poles will increase speed of EMT simulations

# Results

- Fitting 2x2 admittance matrix of pi circuit

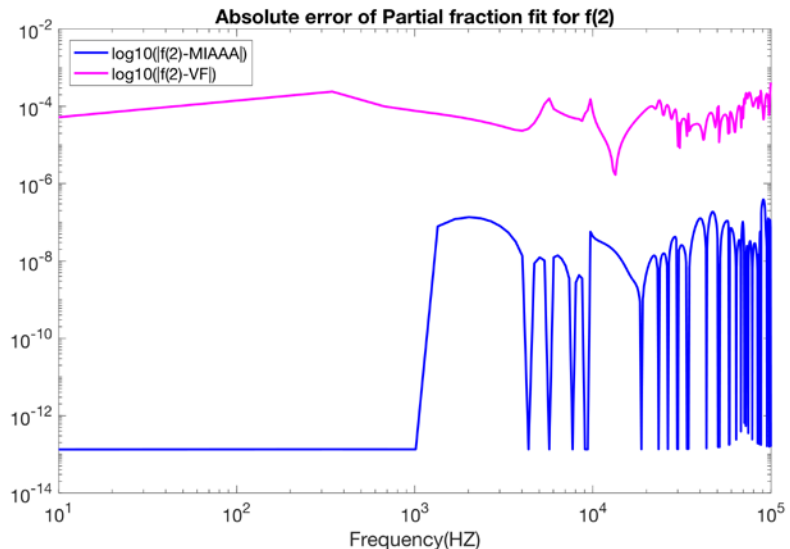
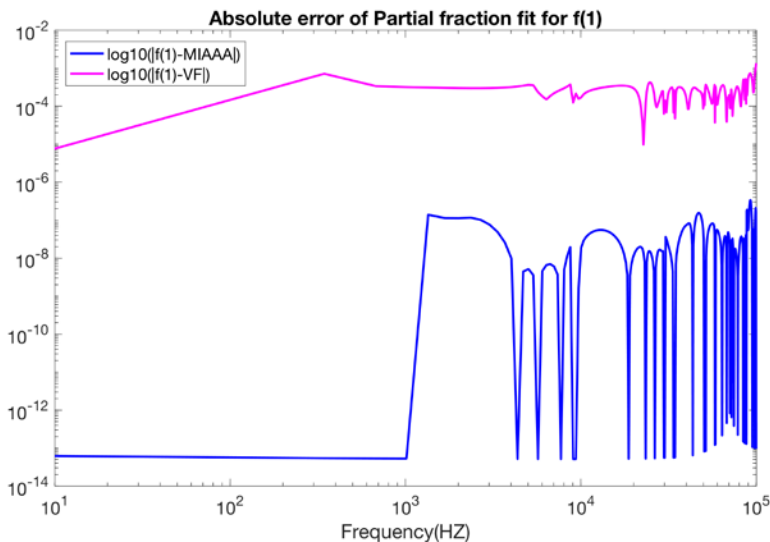
Technique	Order	$\epsilon_{RMS}$	$\epsilon_{relative}$
VF	7	$2.20 \times 10^{-3}$	$8.33 \times 10^{-2}$
MIAAA		$2.18 \times 10^{-4}$	$3.24 \times 10^{-2}$
VF	8	$2.13 \times 10^{-4}$	$1.00 \times 10^{-2}$
MIAAA		$1.63 \times 10^{-5}$	$1.97 \times 10^{-3}$
VF	9	$5.10 \times 10^{-15}$	$2.69 \times 10^{-13}$
MIAAA		$3.75 \times 10^{-16}$	$4.15 \times 10^{-14}$

J. Morales-Rodriguez, E. Medina, J. Mahseredjian, A. Ramirez, K. Sheshyekani, and I. Kocar, "Frequency-domain fitting techniques:

A review," IEEE Transactions on Power Delivery, pp. 1–1, 2019

# Results

- Matching 6 entries of an admittance matrix
- Using 50 poles in VF and 36 poles in MIAAA



D. Deschrijver, B. Gustavsen, and T. Dhaene, "Advancements in iterative methods for rational approximation in the frequency domain," IEEE Transactions on Power Delivery, vol. 22, no. 3, pp. 1633–1642, 2007.

# Future Work

- MIAAA out preforms VF in both number of poles and accuracy
- An important feature of VF that we did not address here is the passivity of the poles.
- We intend to optimize our MIAAA results to further reduce the number of poles needed
- This algorithm could be used to improve results of EMT simulations where VF is currently being used

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