



# EMT cable model premium fitter

*High fidelity rational fitting of frequency transfer function with time delay, ensuring model passivity*

## CONTEXT

Power system design is performed using simulation tools which require, among others, a detailed knowledge of cable models. Indeed, cable model is key for power grid studies. Cable modelling introduce difficult technical challenges due to the propagation of electromagnetic waves across long distances, and to the highly frequency dependent physical behaviour.

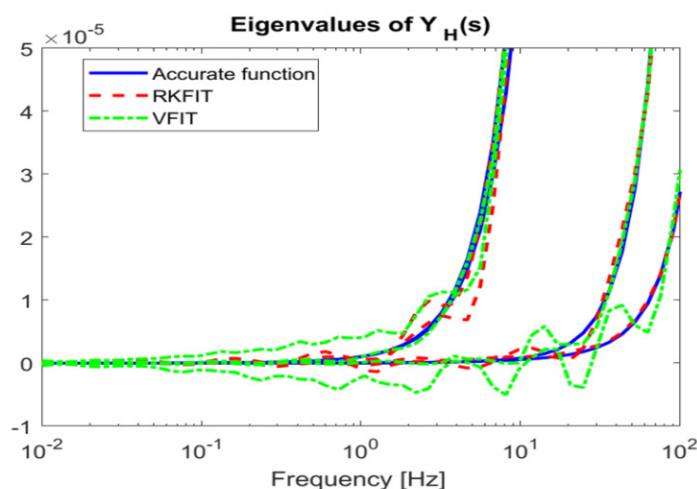
Calculation of the cable system distributed parameters is performed in the frequency domain. The transients are solved in the time-domain using the known inverse transformation of simple rational functions, the frequency dependent impedance and admittance matrices being fitted by a formula using those functions.

The state of the art model using this method is known as the Wide Band model, readily available in commercial softwares. The fitting process is indeed an approximation that can lead to inaccuracies and even instabilities due to the created passivity violations. Simulations may diverge when those violations are excited.

## TECHNOLOGY DESCRIPTION

The Wide Band model is reformulated using an original and robust fitting method based on the rational Krylov approximation algorithm. We found that this fitter is more accurate than the one used in the original implementation of the wide band model known as Vector Fitting. Krylov based approximation showed an enhancement in the fitting and especially at low frequency for HVDC transmission.

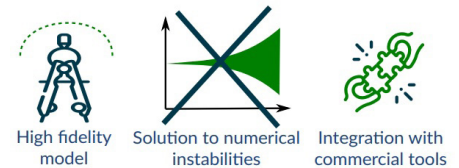
An original and robust passivity enforcement algorithm is proposed to fulfill the passivity criteria on a passivity violated model. This algorithm iteratively improves the accuracy of the rational approximation that relates to the passivity violation. It was shown that after few iterations the algorithm renders a passive and a stable cable model.



## APPLICATION DOMAINS

- EMT simulations
- overhead lines or cables
- EMTP-RV, PSCad, HYPERSIM or RTDS

## ADVANTAGES



## DELIVERABLES

Patent application: FR1874052  
Matlab implementations  
Technical reports

## TRL SCALE



Prototype implementations of the software demonstrated on full-scale realistic problems.

Partially integrate with existing softwares.

Limited documentation available

## SCIENTIFIC REFERENCE

PhD report: « Contribution à la modélisation des câbles HVDC pour la simulation des transitoires électromagnétiques », A. Mouhaidali, Université Lyon 1, Université Grenoble Alpes.

