

# Extrapolation Methods: a tool for accelerating real life problems

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## Abstract

The mathematical model  $\mathcal{P}$  of a real life problem is, typically, a set of complicated non-linear differential equations. The corresponding numerical solution is obtained solving iteratively a, possible, infinite sequence of simpler non linear problems  $\mathcal{P}_i$ ,  $i = 1, 2, \dots$  which approximate better and better the original one. The idea of this iterative process is well known: problem  $\mathcal{P}_i$  uses the solution produced by problem  $\mathcal{P}_{i-1}$  to generate the next approximation of the final solution of the original problem. This algorithm proceeds until some convergence criterion is satisfied.

From a computational point of view, each step of this iterative step may be time consuming and the entire process may require a high number of steps. Thus, it is interesting to investigate the possibility to accelerate the convergence process. In this paper we show the improvements gained using some acceleration techniques in three engineering fields.

First, we show the acceleration improvement obtained applying the behavior of the convergence process of the steady state Navier-Stokes equations. Second, we show the behavior of the convergence process in the simulation of a MOSFET, one of the most important electronic devices, with and without the application of some kind of polynomial acceleration on the Gummel map. Third, we study the solution of a simple non-linear passive electronic net consisting of some diodes and resistors both using Aitken and a polynomial acceleration.

## References

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