

Abstract:

The author proposes to review the main benefits and difficulties when simulating Power Factor Correction stages (PFC). After some presentation of the two types of models (switched and averaged), the paper focuses on the main methods to derive such models and on the information that can be drawn from them. To make it more practical, the paper details the modelling of a Continuous Conduction Mode PFCs where the extensive use of behavioural components leads to a short simulation time.

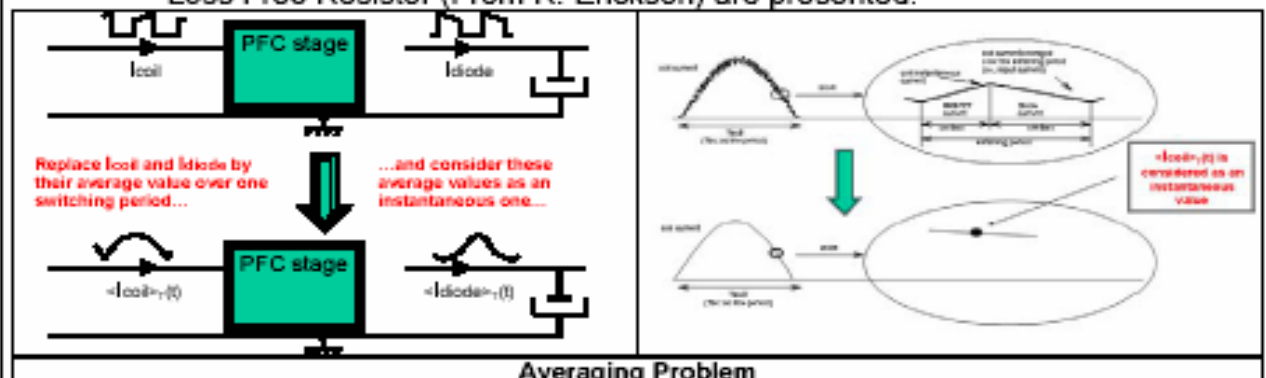
Also, tricks to improve the simulation speed and effectiveness are shown. Finally, comparison between simulation and bench results are given to illustrate the merits of PFC simulation in a practical application: 300 W, wide mains:

- dynamic performance,
- peak and rms current stress within the PFC stage

Some aspects that will be highlighted:

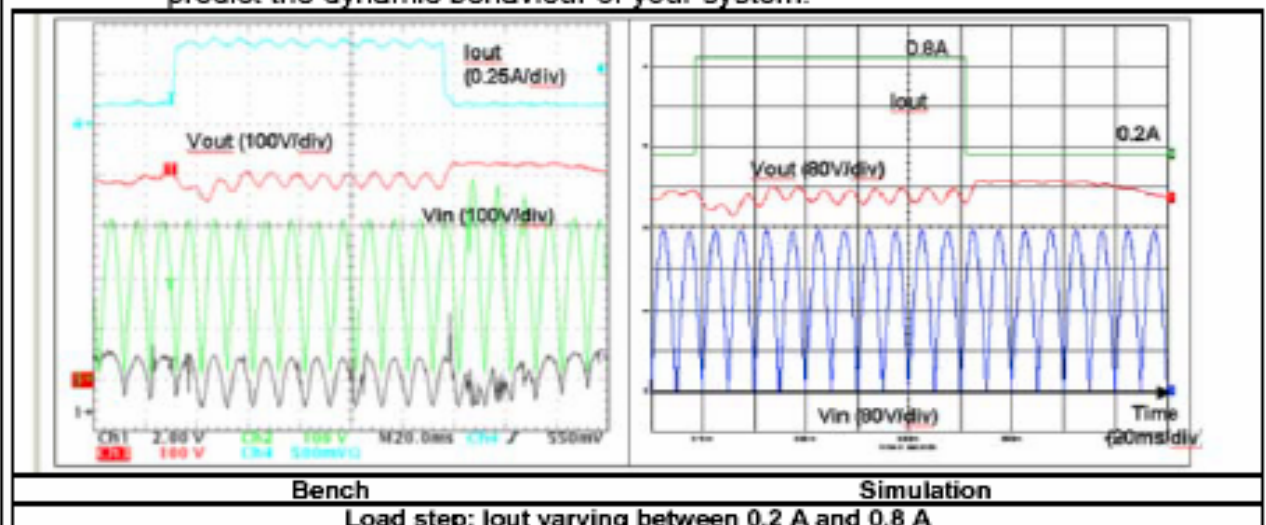
1. Averaged models.

- How to derive them? Given that PFCs permanently modulate the duty-cycle to properly shape the ac line current, techniques like the PWM switch from Vatché Vorperian are not so easy to use. Averaging solutions similar to the Loss Free Resistor (From R. Erickson) are presented.



Averaging Problem

- The practical derivation of one circuit is presented (NCP1653)
- Averaged models are fast and accurately match bench results. They help predict the dynamic behaviour of your system.



Bench

Simulation

Load step: Iout varying between 0.2 A and 0.8 A

2. Switched models:

- They enable to observe the actual waveforms within the PFC stage

