

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Amedeo Varano**

The public defense will take place on **Thursday 15th October 2026 at 5pm** in room **D.0.05** (Building D, VUB Main Campus)

To join the digital defense, please click [here](#)

Meeting ID: 352 089 589 010 280 9

Passcode: sK3id2Ja

**NONLINEAR BEHAVIORAL MODELLING AND DIGITAL PREDISTORTION
VIA A FREQUENCY-DOMAIN VOLTERRA APPROACH**

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Abstract of the PhD research

In today's hyper-connected world, wireless communication is indispensable. As electronic devices continue to shrink in size and weight, power efficiency becomes increasingly important. In digital electronics, substantial gains in energy efficiency have been achieved through aggressive technology scaling. In contrast, the analog and radio frequency front-end benefit less directly from these advances, creating a growing need for accurate models that enable more energy-efficient system operation.

A key component that largely dictates this overall efficiency of a wireless transmitter, is the radio frequency power amplifier. This component amplifies the communication signal to power levels suitable for transmission. Unfortunately, operating a power amplifier at high efficiency, typically comes at the expense of increased nonlinear distortion. This in turn degrades the transmit signal quality. To address this challenge, digital predistortion has become the preferred linearization technique in both academia and industry.

As its name suggests, predistortion compensates for the amplifier nonlinearities by appropriately modifying the input signal in a way that makes the overall transmitter response more linear. A crucial requirement for effective digital predistortion, is the availability of a nonlinear behavioural model that accurately captures the inverse characteristics of the system. In the search for suitable model structures, a well-balanced compromise is needed between the attainable model accuracy, parameter parsimony, and computational complexity. Over the years, several modelling approaches have been proposed that trade-off these requirements. Out of these approaches, the reduced-complexity Volterra-based models have become the de facto industry standard.

This work proposes a novel frequency-domain, Volterra-based model, *ROVA*, that exploits the bandpass nature of radio frequency signals to achieve a more favorable trade-off between model accuracy and complexity. The modelling and predistortion capabilities of the *ROVA* model are validated through both simulations and measurements of radio frequency power amplifiers under a variety of operating conditions. Finally, this work also presents an extension of conventional excitation signals, to enable the characterization and modelling of power amplifiers across varying input power levels.