Simulation of the Behavioral Models of Components Optoelectronics in Language VHDL-AMS

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Given that optoelectronics is being more and more used in the current circuits, it would be very interesting to obtain a library of components to integrate them in a complete system. We present in this communication various possibilities of the use of this language in modeling of optoelectronics components such as diodes, lasers and photodiodes.

Simulation of the behavioural models of diode laser and of photodiode:

1. Results of simulation of a binary model

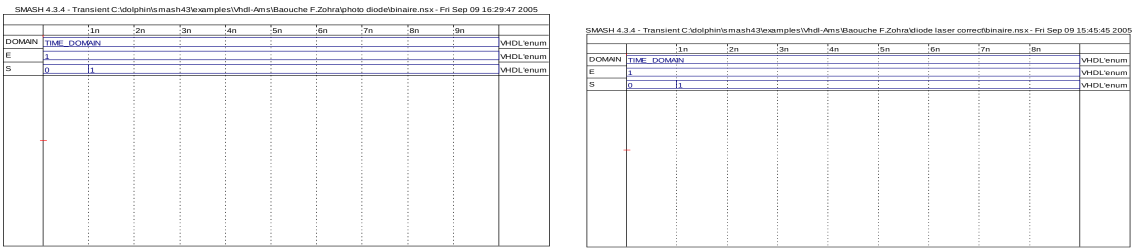


Fig.1: The input-output of: (a) binary model of diode laser, (b) binary model of a photo diode [1].

2. Diode laser in static regime

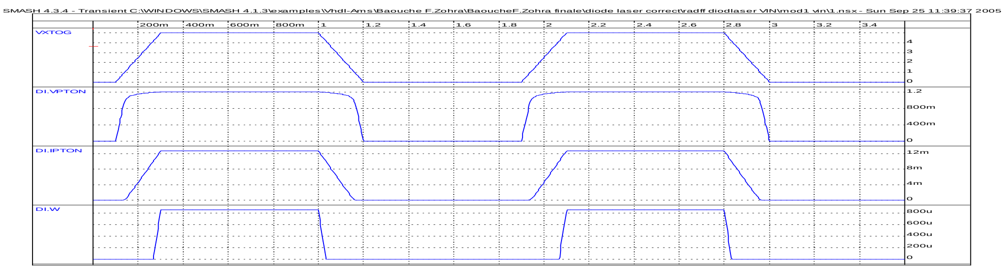
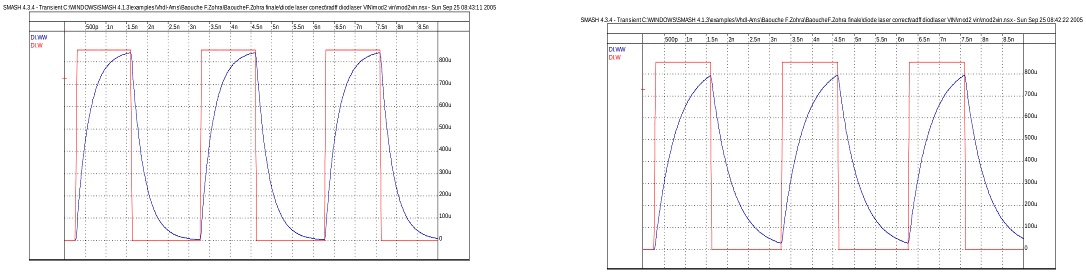


Fig.2: Results of simulation of diode laser in static regime [1].

3. Simulation of a laser diode in dynamic mode



(a) Time-constant τ = 0.3ns (b) Time-constant τ = 0.5ns

Fig.3: Simulation of a laser diode in dynamic mode [1].

4. Simulation of the thermal aspect

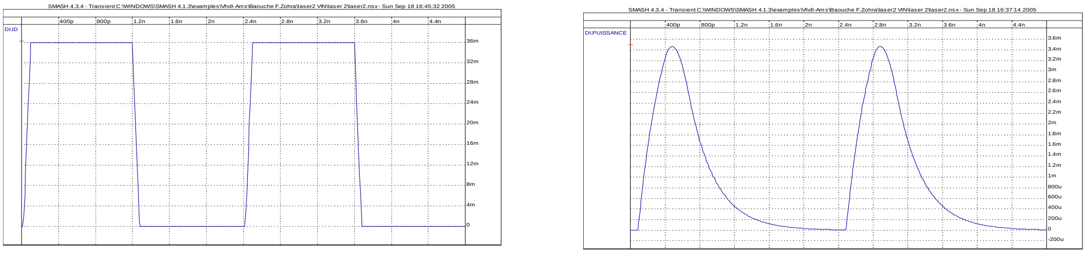


Fig.4: Simulation of the thermal aspect of a laser diode [1].

5. Simulation of the dynamical and electrical model of the photodiode

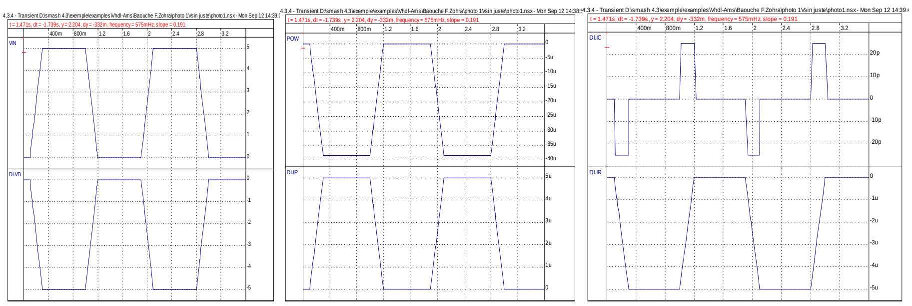
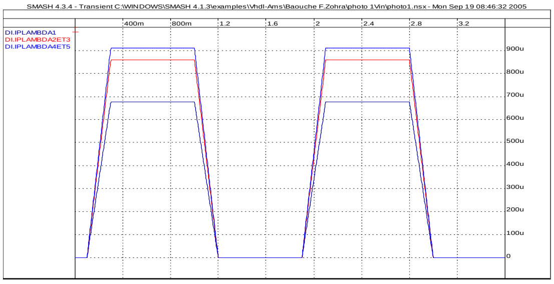


Fig.5: Simulation of a photodiode with an entry in crenels [1].

6. Simulation of the variation of the photo-current according to the wavelength and variation of the dark current with temperature



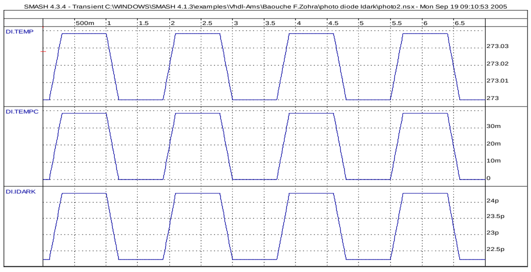


Fig.6: Variation of the photocurrent according to the wavelength, and the variation of I-dark according to the temperature.

7. Conclusion

This work, first of all, allowed us to take interest in the VHDL-AMS language and the model of the optoelectronic components. We chose application of the diodes lasers. However, the features of this component cannot be calculated analytically, but with the help of a simulation tool. With the mixed languages of material description as the VHDL-AMS, one arrives at an encouraging result, since we simulated a laser diode where many domains interact. Not less than 3 different disciplines are present in the simulation: numeric electronics, analog electronics and optics [1].

Reference

[1] F. Zohra Baouche, "Modélisation Comportementale des Composants Optoelectronique en langage VHDL-AMS", Institute of Electronics University of Constantine, Thesis of Magister, 2005. Institute of Electronics University of Constantine.