Optimize the Models about Temperature and Transitional Process by Numerical Elements

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ABSTRACT

This paper examines problems of simulation elements electronic in integrated area. After theoretical materials of principal work simulate processor ways and means - models, computers language at mathematic mean (numerical mean) suggest hold out method of optimization work point with simulate transistor poly-emission. Improvement takes only temperature interval for someone value, but method applicable for other parameters. In this manner it wise range.

Key word: **delay, retardation, transitional process, simulation.**

INTRODUCTION

By experience in any case delay is important by each logical operation. From theirs reality reflects subjection originality result of simulation. Still more logical operations ought, to one at this distance of time at delay of this operation. Once again that at work from

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logic operation they follow one a trace another and delay from it too grow.

Every time slight error of heaping and calculation set a task of error, inaccuracy at simulation. In practice oneself apply by discreet process simulation let optimize similar function. If models is digital, (numerical data) et description by means of VHDL, to work is difficult of access if need to standard function width at most just to the original. Partially determination of problem whit delay in models is theirs description in parts. This is enable to parts descript in standard in VHDL languish function

For every discreet element et his model in any case use the concrete kind. For example, to connected electrical elements in system present in one model else connected models.

Basic conception for description of digital electronic circuit scheme with electrical undone model is this en VHDL. This conception has an effect in many level of abstraction – from one logical element to total system hardware.

Per example: Management structure in VHDL is management port with reality value.

```
BEGIN
    word <= 00000, wait 10ns
    word <= 00001, wait 10ns
    word <= 00011, wait 10ns
    word <= 00111, wait 10ns
    word <= 11111, wait 10ns
END PROCESES
```

In environment VHDL there are two species retardation: momentum and transport. Delay in variable type or not lineal in VHDL not support. List roll is restricted by:

wait: - Process not activity from operation to finish
wait: **on** (follow list fro work)
wait: until (execute by condition)
wait: for (execute after definite time)

In many times necessary delay deferent in standard VHDL procedure. In that case procedure in VHDL takes standard value. In example present delay who answer in function but in the lab is indefinite, especially this lab is divide in phase et his is important.

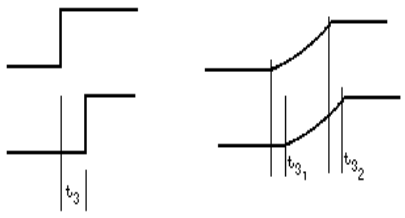

fig. 1. Transitional process

Serious dimension there are tension limit in models et time for this models via is it work. ect. (tu).

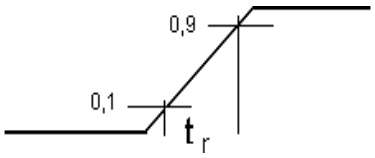

fig. 2. Transitional tension

In this paper suggest description on transitional process by divide this process in lab. A description is in dynamic work area, et account is standard functions in VHDL.

By descriptions in models used value et parameter function with who approach parameter in reality. In this way prevent some failing in investment procedure in program.

- Influence in temperature

With temperature variance in each elements of model set in considerable change in algebraic calculation in work the models. Par example for transistor - description mathematics by work model joint in ten characteristic equation and 29 parameters per each. [9]

Parameters is: $D_1, D_2, \alpha_{N0} I_1,$ $\alpha_1 I_2, G_{CE},$ $R_{BB^8}, R_{EE^8}, R_{CC^8}, Z_m I_B, C_{DE}, C_{DC}, C_{TE}, C_{TC},$ $I_{E0}(I_{C0}), M_E(M_C), T_E(T_C), \alpha_{N0}(\alpha_I), A_0, A_1, A_2, A_3$ $, G_0, G_1, G_2, C_{TE0}(C_{TC0}),$ $\varphi_E, n_E(\varphi_C, n_C), \tau_E(\tau_C),$ $T_0, T_1, T_2.$

with:

- If temperature not read $\Delta t^\circ = 0$ and many other parameters take on trust work out compromise and simplification of the model. Consequently decrease number of characteristic equation end many parameters in them is coefficient.
- If give an account temperature $\Delta t^\circ \neq 0$, have full number of characteristic equation.

WORK PROBLEM

Models and digital circles for digital simulation.

Models are abstract or materials system in spirit realization. This system reflected objects and be able to replacement. A reality object and replacement description is model. Make a study of information by object give norm for principal work models.

Models is categorize in differing indication, example: 1) by methods of reflection or else way re-create objects; 2) by methods of models work (law of the work); 3) by specific characteristic in original who investigate or reproduce in model e.t.c.

Classification of models according to construct is two big groups. : ideally and material.

1) Ideally model exist only in memory persons. To article pass in phase mental models. Each model in first exists in consciousness of the man as an image valid object, as the any theoretical circuit. All models who are created of the man except for that they imaginary they also are ideal independently that outward fixture in marks, figure, drawing or circuit. Are ideal character in model is caused in that all calculations in them are done(made) only in memory. Models in memory it interstitial product for construction material models. These models can a life in more full independent and that can not realize. It is a lot of ideal models can not realized actually.

2) Material models его of which all models use on is ready or with which are created artificial from the man. To material models of model be constructed from computers, it so are named numerical model. These models are usually actually and they are divided into three basic groups: spatial (geometric) kind, pphysically kind and mathematical kind.

- Spatial (geometric) models reflect spatial properties and attitude(relation) in the original. Similarity between sampler and original is based on geometrical similarity.
- Ratio between sampler and the object at physical similar samplers is based on physical similarity witch present identical physical law.
- At mathematical similar samplers similarity is based on mathematical analogy witch might be structural or functional.

This publication is searching for similarity by element's mathematical process. For example: it's used multiemitter transistor.

THEORETICAL VINDICATION

Let we look at the universal, non-linear constantan current transistor's sampler in two rates; static and dynamic.

It's made on the base of injection Eber-Mol's samplers witch is developed and refreshed as approach the mapping and mathematical description and characteristically parameter. The equivalent circuit of the universal sampler consists of elements witch expresses important physical effect and processes in transistor's structure. Mathematical sampler's description is by 10 characteristically equations with 29 parameters.

A part of constant current sampler's descriptions equations are the following:

$$I_1 = I_{E0} e^{T_E \Delta t^\circ} (e^{U_1 / M_E U_T} - 1) \quad (1)$$

$$I_2 = I_{C0} e^{T_C \Delta t^\circ} (e^{U_2 / M_C U_T} - 1) \quad (2)$$

$$\alpha_{N0}(t^\circ) = \alpha_{N0}^{(25^\circ)} + T_A \Delta t \quad (3)$$

$$\alpha_{N0} = A_0 + A_1 U_1 + A_2 U_1^2 + A_3 U_1^3 \quad (4)$$

$$G_{CE} = G_0 + G_1 I_1 + G_2 I_1^2 \quad (5)$$

Temperature potential U_T and temperature increasement Δt° are performed like diode (9) and (10).

Knowing of parameter's numerical value for certain type transistor gives a chance to perform all graphic transistors' characteristics by modulating equations during definite environment temperature. The mistake in the in to modulating of those dependences is under 5%.

In difference of transistor the ideal semiconductor diodes sampler with a junction and its VA characteristics are performed by the following equations:

$$I_d = I_s\left(e^{U_D/U_T} - 1\right), \tag{6}$$

където:

I_d , U_D diod's currents [A] and diod's voltage [V];

I_s - diod's saturation current (reverse current) [A];

U_T - temperature potential. It's definite by the formula (7):

$$U_T = \frac{kT}{q}, \tag{7}$$

where: k – Bolcman's constant ($k = 1{,}3810.10^{-23}$ [J/K]); T – absolute temperature, K; q – charge of electron; e – constant e = 2,71828 at indoor temperature (300 K), $U_T \approx 26$ mV.

Mathematical description to the diod's sampler uses equations for real diode:

$$Id = Ido.e^{Kd\Delta t}\left(e^{Ud/MdU_T} - 1\right), \tag{8}$$

$$\Delta t^{\circ} = t^{\circ} - 25^{\circ}, \tag{9}$$

$$U_T = \frac{t^{\circ} + 273}{11600}, \tag{10}$$

$$Rd = Q_0 + Q_1 Id + Q_2 Id^2 + Q_3 Id^3, \tag{11}$$

$$Rdy = \frac{Ud^{=}}{Id^{=}}, \tag{12}$$

Equation (9) is taking in to consideration the temperature's **t°** increase above the normal temperature 25° and gives a chance to be performed quantitative diod's temperature qualities with know approximation.

The parameter **Md** is emissitive and expresses constructive junction's specialties (special features).

EXPERIMENTAL INVESTIGATIONS

Has to a kind of the equation for calculations of the transistor and his about the diode - the temperature difference Δt is defined(determined) to one and too method. [9].

For change of temperatures for three value (15°, 25° ,35°,) is often equation vary in the following a kind [3]:

$$\alpha_{N0} = \alpha_{N0}^{(25^{\circ})} - 10T_A \tag{13}$$

$$\alpha_{N0} = \alpha_{N0}^{(25^{\circ})} \tag{14}$$

$$\alpha_{N0} = \alpha_{N0}^{(25^{\circ})} + 10T_A \tag{15}$$

The results can will be presented graphically if the temperature difference is measured correctly. On fig. 3. is presented $\Delta x'$ and $\Delta x''$ accordance +10 and -10 than $\alpha_{N0}^{(25^{\circ})}$. Within the framework of that range it is possible to make of optimization for models with which inspected.

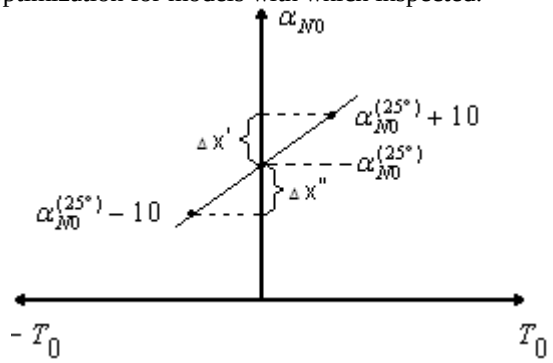

fig. 3. Temperature interval

INFERENCE

This means enable give a chance for process of mathematical calculation in optimization in models.

Element T_A by 25° is eliminate in participation by mathematical calculations.

Existence of coefficient T_A is necessary in fixed temperature interval. So itself reach many large (exact) approaches. Restriction is conditionally. (indicated three temperature is random elected).

CONCLUSION

In the publication is offered model semiconductor multiemitter transistor in which give additional parameters, in this case temperature difference. Which method is offered it is possible using and for other parameters in model of the transistor.

1. Optimization to concern to one exacted approach of transient (the description of transient for analog elements in digital environment).

2. With this way it is possible the interval watches (keeps up) of temperatures in is very much limited and then it is possible will receive 3D the image graphics. It is very important specialty for reception and calculation on thermal models and such working on integrated environment

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