

**DESIGN OF BROADBAND MICROWAVE AMPLIFIERS WITH
PRESCRIBED GAIN-FREQUENCY SLOPES**



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Tuan

**TAJUK PENYELIDIKAN: DESIGN OF BROADBAND
MICROWAVE AMPLIFIERS WITH PRESCRIBED GAIN-
FREQUENCY SLOPES**

Dengan hormatnya perkara di atas adalah dirujuk.

Sukacita dimaklumkan bahawa Mesyuarat Jawatankuasa Penyelidikan ke-68 pada 17 September 2003 telah membuat keputusan:

- i. Bersetuju meluluskan cadangan penyelidikan yang telah dikemukakan oleh tuan, Encik Mohd Nor Md Tan dan Encik Saiful Ridzuan Ariffin.
- ii. Tempoh projek penyelidikan ini ialah **12 bulan**, iaitu bermula **1 Oktober 2003** hingga **30 September 2004**.
- iii. Walaubagaimanapun kelulusan ini adalah **bersyarat** iaitu tuan perlu meminda kos bagi yuran keahlian badan professional daripada 2 tahun kepada satu tahun sahaja.
- iv. Kos yang diluluskan ialah sebanyak **RM 50,000.00** sahaja daripada Geran MOE. Penggunaan geran yang diluluskan hanya akan diproses setelah perjanjian ditandatangani dan pindaan ke atas keperluan kewangan telah dibuat.
- v. Tuan perlu membelanjakan **50%** daripada geran penyelidikan yang telah diluluskan bagi projek tuan dalam tempoh **6 bulan** pertama projek berjalan. Sehubungan itu, pihak Biro akan memantau penggunaan geran penyelidikan tuan untuk memastikan **50%** daripada jumlah geran yang diluluskan telah dibelanjakan sehingga bulan **Mac 2004**.

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ABSTRACT

A computer-aided design routine was developed using *Matlab* to synthesize inter-stage matching networks with prescribed gain-frequency slope for use in broadband microwave amplifiers. A graphical user interface (GUI) was developed within *Matlab* to assist the user in the design process. The GUI does not require prior knowledge of *Matlab* and only requires the user to enter the required design parameters. The software developed then prompts *Matlab* to solve polynomial equations associated with the insertion loss function of the inter-stage network defined by the user. The result obtained is given in the form of a schematic diagram of the matching network of lumped circuit elements which can then be imported to commercially available microwave design packages for circuit simulation. The GUI also allows the user to plot the insertion loss response as a function of frequency. In addition to its application in microwave amplifier design, the GUI is also capable of synthesizing matching networks of arbitrarily-defined gain-frequency slopes for other, as yet undefined, applications.

The software developed is applied to the design of a two stage broadband microwave amplifier for use in the frequency range of 4 to 8 GHz. The amplifier uses NEC GaAs MESFET transistors which exhibit a gain roll-off of approximately 6dB/octave in the microwave region. The GUI was used to synthesize a matching network of 6 dB/octave slope to compensate for this roll-off. The amplifier designed exhibit a flat

response over the pass-band with gain of the order of 9 ± 0.5 dB, and average in-band input and output VSWRs of 3 and 7 respectively.