بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

Women's College
Physics Department

Design, Analysis and Applications of Some Signal Filters, Based on OP-AMP, on Different Environmental Conditions

A Thesis
Submitted in the Partial Fulfillment for M. Sc. Degree in Physics

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بسم الله الرحمن الرحيم

(وقل أعملوا فسيرى الله عملكم و رسوله و المؤمنون)

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ABSTRACT

The design, analysis and operation of second order active filters based on operational amplifiers, of the type LM3900, were investigated experimentally, and simulated applying Electronic Workbench programs, and theoretically applying home developed computer programs. The study concerned with three types of second order active filters, that is; low-pass (low-pass Butterworth second order active filter and low-pass Chebyshev second order active filter), high-pass (high-pass Butterworth second order active filter and high-pass Chebyshev second order active filter) and band-pass second order active filter.

The study includes the design and excution of the different circuits, and the effects of each circuit element on the characteristics of the active filters. From which, the active filter electrical parameters; such as maximum gain, cutoff frequency (in case of low-pass and high-pass filters) or bandwidth (in case of band-pass filter) and steepness factor were calculated. Also, a special program, namely: Electronic Workbench was applied for filter circuits simulation. In addition, special computer programs were developed to conform the previously obtained results.

The study was extended to include the effect of temperature on the characteristics of the operational amplifier and the filter circuits, in the range from room temperature (17 ^{0}C) up to 90 ^{0}C. It is to be noted that the temperature variation causes the operational amplifier gain to decrease. As a result, the active filters were shown to be sensitive to temperature variation where their maximum gain, cutoff frequency and steepness factor were shown to be temperature dependent.

Also, the effects of nuclear radiation (gamma-rays and electron-beams) on the electrical characteristics of the operational amplifiers and their active filters were investigated. For the operational amplifier, the device gain and spectral response were shown to increase as a function of radiation dose. As a result, an increase in the maximum gain and cutoff frequency of high-pass filter or bandwidth of band-pass filters was noticed. On the other hand, for low-pass filters it is noticed that their response curves are radiation independent.

Finally, temperature annealing of the irradiated operational amplifiers was carried out applying either shelf or oven techniques.

LIST OF ABBREVIATIONS

LP	**:**	**Low-Pass,**
HP	**:**	**High-Pass,**
BP	**:**	**Band-Pass,**
VCVS	**:**	**Voltage Controlled Voltage Source,**
IGMF	**:**	**Infinite Gain Multiple Feedback,**
OP-AMP	**:**	**Operational Amplifier,**
V_{in}	**:**	**Input Voltage,**
V_{out}	**:**	**Output Voltage,**
BW	**:**	**Bandwidth,**
BWS	**:**	**Stopband bandwidth,**
OP-AMP	**:**	**Operational Amplifier.**

LIST OF SYMBOLS

F_c	:	Cutoff frequency,
F_{c1}	:	Lower critical frequency,
F_{c2}	:	Upper critical frequency,
F_0	:	Center frequency ,
Q	:	Quality factor,
DF	:	Damping factor,
C	:	Capacitance,
R	:	Resistance,
H_0	:	Pass band gain,
A_s	:	Steepness factor,
F_s	:	Frequency corresponding to the beginning of the stopband,
n	:	Order of filter or number of poles,
m	:	Ratio of capacitor values or constant,
C_n	:	Chebyshev polynomial of the first kind of degree n,
ε	:	Constant that sets the passband ripple,
G	:	Gain,
M	:	Maximum gain,
γ	:	Gamma-ray.