Computer-Aided Engineering

Adapted from

C.N.Nightingle and J.K.Fidler ., Computer-Aided Circuit and System Design.,U.K +IEEE papers

Lecture 1

Prof .Dr.Eng.ARN

Contents

Syrian Private University

Faculty of Informatics & Computer Engineering

Departments: Communication and Networking Engineering

: Computer and Control Engineering

Course Number: COCE701.

Course Name :Computer-Aided Engineering (CAD).

Semester: Fall, Academic Year: 2013-2014

Credit Hours: 3 credits, Theoretical 3 Hours,

Pre-requisites for: ELC2 (CCCC601)

Duration: (14 weeks), Saturday +Wednesday (2X1.5=3 ch.H) per week .

Computer-Aided Engineering(CAD)

- Course outcome 1st topic

1. To understand the nature of CAD-CAM procedure that are suitable for design of electronic circuits and systems .
2. To study how to formulate the design problem as an engineer .
3. To be able to get benefit from mathematics and your specialization what ever it is to design by computer any circuit /system(mixer of the numerical analysis with characteristics ,model and programming .
4. 1st aid to you in the modern design life .

Course outcome

5. Although to give students an appropriate background on different optimization methods applicable for the realization of circuits and some applications.

At the end of this course, students are expected to know:

.Basics of CAD-CAM Structure
.The relation (عملية الربط) between the computer, electronic design and programming.
.To understand how to simulate the circuit by the computer

Course outcome

CAD-CAM Scheme .

Circuit Analysis for computer .

Optimization Methods

Error function Calculation

Quality of the design

Assessments

Activities	15%
Lab/assignments	15%
Mid-term Tests	30%
Final Exam	40%

Books

Text books:

1.Electronic devices and circuit theory by Robert L. Boylestad and Louis Nashelsky.

2.Power point by Dr .Prof.ARN.

3.C.N.Nightingle and J.K.Fidler ., Computer-Aided Circuit and System Design .

4.Introductory circuit Analysis , Boylestad ,Tenth Edition

Further reference Books

- “Microelectronic Circuits”, by: Adel S. SEDRA and Kenneth C. Smith, 5ftEdition, McGraw-hill, 2004.
- “Microelectronic Circuit Design”, by: Richard C. JAEGER and Travis N. BLALOCK, 3rdEdition, McGraw-hill, 2007.
- “Introduction to Electronic Circuit Design” by: Richard SPENCER and Mohammed GHAUSI, 1stEdition, Prentice Hall, 2002.
- “Computerized Circuit Analysis with Spice”, by: Thomas W. THORPE, Prentice Hall, 1991.
- “Electronic circuits discrete and integrated”, by: D. Schilling and C.BELOVE, 3rdEdition Prentice Hall, 1989.
- “Microelectronics : Digital and Analog Circuits and Systems”, by: Jacob MILLMAN, McGraw-hill college, 1987.

Class Schedule

5+9/10/2013	Introduction	W1
12+16/10/2013	CAD-CAM Block diagram	W2
19+23/10/2013	Specifications ,initial guess	W3
26+30/9/2013	Network analysis Quiz1	W4
2+6/10/2013	Optimization methods ,classification	W51
9+13/10/2013	Optimization methods ,types	W6
16+20/10/2013	Constraint and unconstrained opt.M Quiz2	W7
23+27/10/2013	Mid-term Exam	W8
30/10+4/11/2013	Error function formulation	W9
9+13/11/2013	Error function formulation	W10

Class Schedule

16+20/11/2013	Derivatives for optimization	W11
23+27/11/2013	Applications Quiz3	W12
30/11+4/12/2013	Parametric sensitivity	W13
7+11/12/2013	Applications	W14
14+18/12/2013	Revision	W15
21/12 to 26/12/2013	Final Exam	W16
28/12/-2/1/2014	Final Results	W17

General Rules in Class

- **Attendances**
  - **Do not be absent**
  - **Be at time**
  - **Turn off your mobile phone**
  - **Do not talk with your neighbors**
  - **Pay attention**
- **Lectures**
  - **Read sections in text and slides before class**
- **Do Homework.**

The problem of approximation may be considered from a different point of view. Sometimes experimental results, given in the form of either a curve or table, must be used; sometimes a complicated mathematical expression must be replaced by a simpler and more easily treated form. However, the choice depends on the desired result.

There are many ways in which a given curve can be replaced by these simpler functions. An approximation can be found in the form of either:

(a) a polynomial; or

(b) a frequency response at m discrete frequency points.

Classical network synthesis procedures such as the **insertion loss synthesis** technique developed by Darlington, Cauer, Piloty and Orchard, **or the RC network design theory** of Guillemin, Ozaki **and others apply to a restricted range of design problems and realizations.** *Also, not all possible specifications can be satisfied by the exact classical methods.* For example, allowing the loss to be arbitrary in'the design process makes the live difficult.

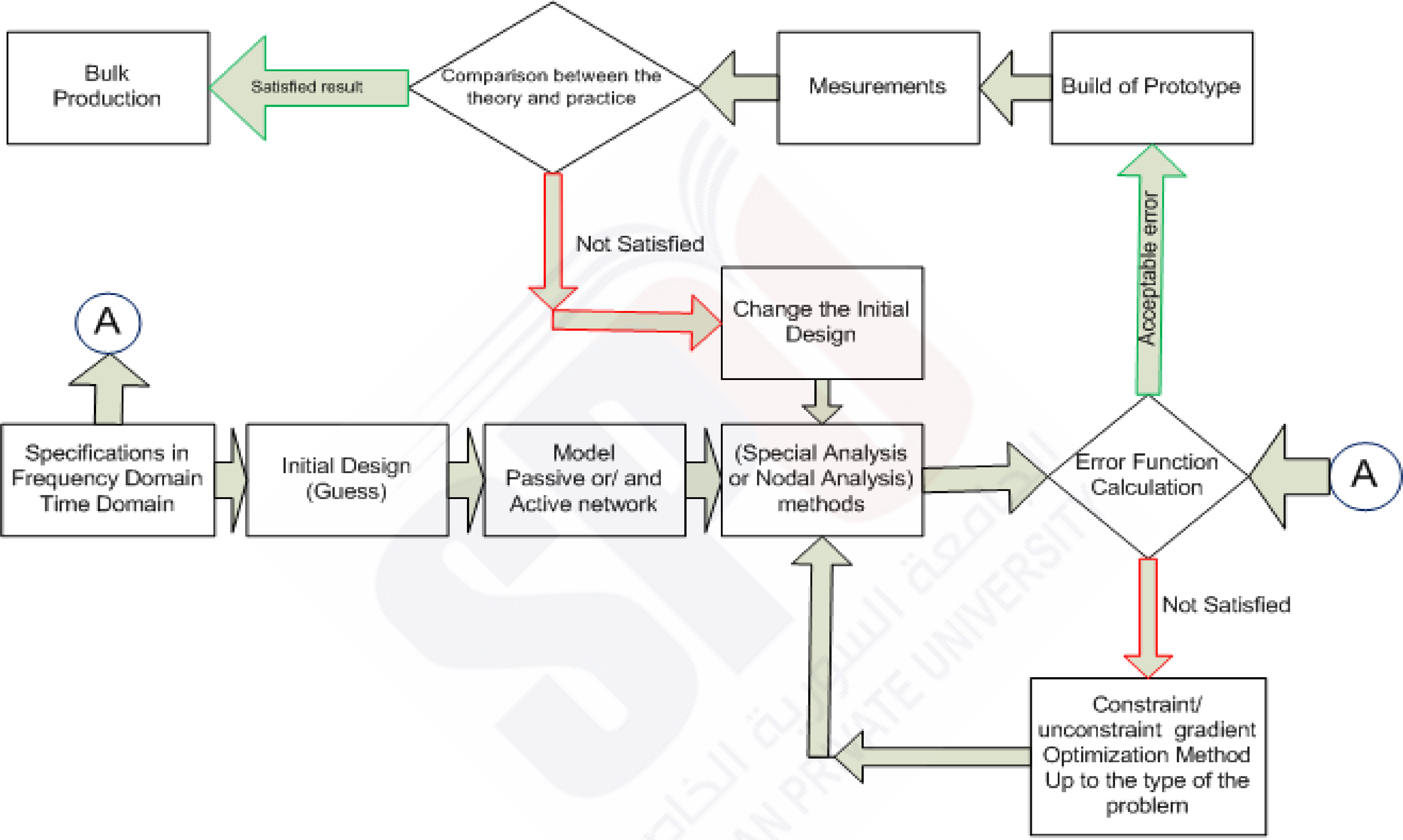
The digital computer plays a key role

to avoid the above mentioned restrictions if it is used as an aid to incorporate all kinds of constraints and can lead to compromise solutions and can accommodate prescribed active elements, non-linearities , parasitic, as well as restrictions on the types and values of the resulting elements.

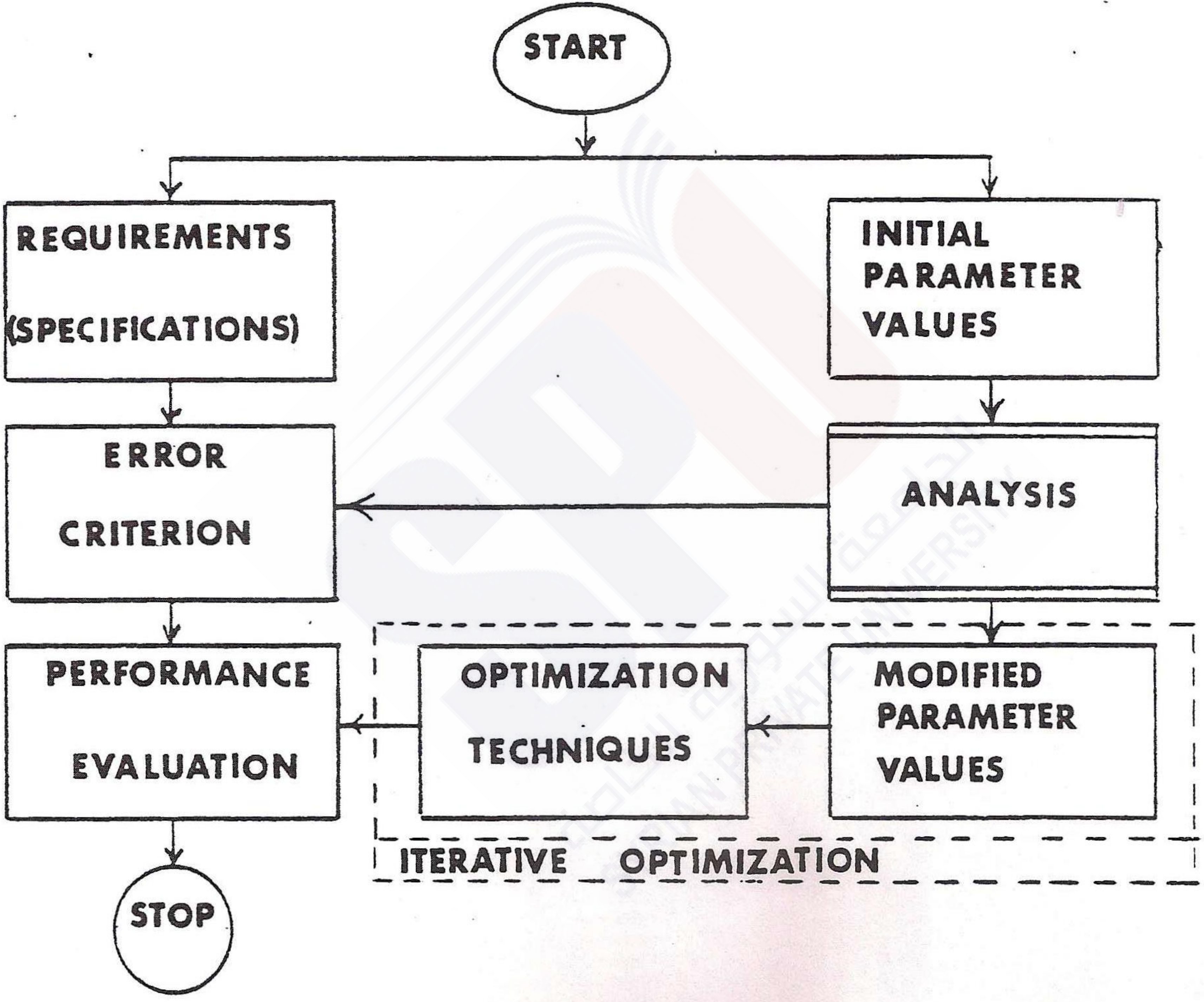
Filter design using iterative optimization techniques is based on the procedure shown in the following Figure. There are two approaches to formulating an error measure in filter design:

1) Amplitude matching method; and

2) Coefficient matching method.



Computer-Aided Design - Computer-Aided Manufacturing scheme


START
REQUIREMENTS (SPECIFICATIONS)
INITIAL PARAMETER VALUES
ERROR CRITERION
ANALYSIS
PERFORMANCE EVALUATION
OPTIMIZATION TECHNIQUES
MODIFIED PARAMETER VALUES
ITERATIVE OPTIMIZATION
STOP

The error measure, relating to the difference between the specified and realized performances can be reduced by using one of the above methods. Both methods will be discussed later on.

Amplitude Matching Method

Let the specified frequency response approximated by a function F = |F(jw)| and the realized response describing the final optimum network by G = |G(jw)| . In amplitude matching approach, the function of their difference f[F-G] determines the error at a set number frequencies (say m= : thus i = 1, 2, ..., m). This error function generally depends on the form of the desired function F and on the choice of sampling points.

Amplitude Matching Method

The solution of the approximation problem may be stated as the problem of determining the order and parameters of a rational polynomial transfer function, such that the function fits within a set of prescribed frequency domain tolerance boundaries in some hopefully optimum manner.

Amplitude Matching Method

- At every sampling point the specified and realized performances are compared using the appropriate error function which is formulated according to the nature of the assumed problem. The network response at intermediate frequencies is unconstrained and may fail to satisfy the requirement.

Amplitude Matching Method

- Hence, this method is a very expensive and time consuming one in terms of CPU times. This is a real problem when the number of samples has to be increased to have good matching. Also, the user has no control on the intermediate frequencies between the chosen sampling points.

Amplitude Matching Method

- Despite these disadvantages the amplitude matching method has been used by many authors . This point matching method can find a suitable place for approximation when the coefficient matching approach cannot be used.

Amplitude Matching Method

It can be shown that amplitude matching methods provide satisfactory results for designing new types of active filters derived from lossy prototypes assuming non-ideal operational amplifiers, where coefficient matching methods cannot be used.