Module Leader

Dr M J Crisp

Lecturer

Dr M J Crisp

Timing and Structure

Lent term. 75% exam / 25% coursework

Prerequisites

3B1 (Assumed)

Aims

The aims of the course are to:

- Provide a system level overview of RF and Microwave, so that system performance can be predicted and optimised to meet a specification

Objectives

As specific objectives, by the end of the course students should be able to:

- Be able to apply network analysis to an RF system
- Understand the effects of noise, linearity and gain in cascaded RF systems
- Be able to optimise impedance match of an amplifier as a tradeoff of noise, linearity, bandwidth and stability
- Understand the operation of passive RF networks (Couplers, splitters, attenuators) and limits on their performance
- Have a knowledge of range of methods to improve amplifier performance
- Understand a range of RF system applications and their performance requirements

Content

It is proposed that this module will focus on the system aspects of RF design (as opposed to circuits). Therefore the overall aim is that circuits (amplifiers etc) can be reduced to a blocks with a minimum number of parameters from which the system performance can be estimated.

Preliminary Syllabus

1. Network Analysis

- 2-port and multi-port devices
- Impedance, Scattering and Transmission parameters, their relationships and uses
Signal Flow Graphs
Two port power gains

2. Noise and Distortion
   - Noise sources in RF systems
   - Noise figure
   - Noise in passive networks
   - Noise of mismatched devices
   - Effects of Distortion
   - Measures of distortion and intermodulation
   - Dynamic range
   - Noise and distortion of cascaded devices

3. Impedance Matching Methods
   - Limits on achievable matches
   - Distributed Impedance matching methods
   - Broadband matching

4. Amplifier Design
   - Stability
   - Conjugate matching
   - Design for low noise
   - Design for high power and low distortion

5. RF System Architecture
   - Zero IF
   - Software Defined Radio

6. RF System Applications
   - Radar
   - Passive RFID
   - Radio regulations

Coursework

<table>
<thead>
<tr>
<th>Coursework</th>
<th>Format</th>
<th>Due date</th>
<th>&amp; marks</th>
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<tbody>
<tr>
<td>CAD Amplifier design</td>
<td>Individual</td>
<td>Weds week 9</td>
<td>[15/60]</td>
</tr>
<tr>
<td>Using industry standard software, the performance of a microwave low noise amplifier will be investigated to maximize performance.</td>
<td>Report anonymously marked</td>
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<td>A brief getting started demonstration will be given in lectures and a drop in session organised for software trouble shooting</td>
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<td>Learning objective:</td>
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<tr>
<td>- Familiarisation with microwave simulation capabilities</td>
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<td>- Design for an amplifier to meet specifications.</td>
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Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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Source URL (modified on 20-05-21): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b24-radio-frequency-systems-2021-22

Links
[1] mailto:mjc87@cam.ac.uk