EEC 655/755 Satellite Communications

Catalog Data: EEC 655 - Satellite Communications(4 credits)
Prerequisite(s): EEC 651.
Satellite channel, satellite link analysis, satellite electronics, frequency division
multiple access (FDMA), time division multiple access (TDMA), code division
multiple access (CDMA), frequency-hopped communications, on-board
processing, satellite cross-links, VSAT networks, mobile satellite networks.

Text: T. Pratt, C. Bostian, and J. Allnutt, Satellite Communications, John Wiley,
2003 (1st ed. 1986)

References:
- Fuqin Xiong, Digital Modulation Techniques, Artech House, 2000 or second
- R. van Nee and R. Prasad, OFDM for wireless multimedia Communications,
  Artech House, 2000
- R. Gagliardi, Satellite Communications, John Wiley (originally by Van
  Nostrand Reinhold), 1991
- Articles in the literature.

Course Description:
This course puts emphasis on the network and system aspects of the satellite
communications. Basic modulation, error-control coding and link budget are not
covered since they were taught in Digital Communications. However advanced
topics in modulation and link budget will be added. Topics covered are: orbital
aspects of satellite communications, satellite subsystems, advanced modulations
(MSK-type modulations, continuous phase modulations, quasi-constant
envelope modulations), OFDM for satellite communications, multipath and rain
effect on satellite link design, multiple access (FDMA, TDMA, CDMA),
packet-switched satellite network, VSAT networks, and mobile satellite
networks.

Instructor: Dr. Murad Hizlan
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Grading:
Midterm Test 40%
Final Exam 40%
Term Project (due by the semester end) 20%
Homework will be assigned and collected. Answers of homework will be provided.

Course Outline:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>Chap. 1, (Pratt et al)</td>
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<tr>
<td></td>
<td>Orbital mechanics</td>
<td>2.1 (Pratt et al)</td>
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<td>2</td>
<td>Look angle determination</td>
<td>2.2 (Pratt et al)</td>
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<tr>
<td></td>
<td>Orbital effects and launches</td>
<td>2.3-2.6 (Pratt et al)</td>
</tr>
</tbody>
</table>
3 AOCS, TT & C
   Transponders & Antennas 3.1-3.4  (Pratt et al)
4 Modulations for satellite communications 3.5-3.7 (Pratt et al)
5 Modulations for satellite communications Selected sections from Xiong
6 OFDM for satellite communications Selected sections from Xiong
   and Literature
7 Multipath and rain effect on link design Chapter 4 & 8 (Pratt et al)
8 Review
   Midterm Test (in class, open book)
9 Spring Recess
10 Term project assigned
   Topic 1: OFDM techniques in satellite communications
   Topic 2: Multiple access technologies in satellite communications
   Including but not limited to FDMA, TDMA, and CDMA.
   Topic 3: Network technologies in satellite communications
   Including but not limited to Packet Switched Satellite Network, VSAT, and Mobile Satellite Network
   Information Literacy, literature search methods, practice
   Presented by Dr. Xiong
   Information Literacy, literature search methods, practice
   Presented by Theresa Nawalanic (librarian)
11 Multiple Access (FDMA, TDMA, Demand Access, Random Access, Packet radio CDMA)
   Chapter 6 (Pratt et al)
12 Multiple Access (FDMA, TDMA, Demand Access, Random Access, Packet radio CDMA)
   Chapter 6 (Pratt et al)
13 VSAT networks Chapter 9 (Pratt et al)
14 LEO and non-geostationary satellite Chapter 10 (Pratt et al)
15 Direct broadcast satellite television and radio Chapter 11 (Pratt et al)
16 Satellite navigation and Global positioning system Chapter 12 (Pratt et al)
   Term Project Due
   Final exam (take home) assigned
17 Final Exam due at 4:00 pm on Tuesday, May 10