

Engenharia Eletrônica



**UNIVERSIDADE FEDERAL
DE SANTA CATARINA**

Prof. Fernando Rangel de Sousa

Engenharia Eletrônica

- Emergiu com a invenção do rádio
- Evolui com os semicondutores
- É a engenharia que fornece as soluções tecnológicas para as grandes inovações do século



1 diodo
semicondutor



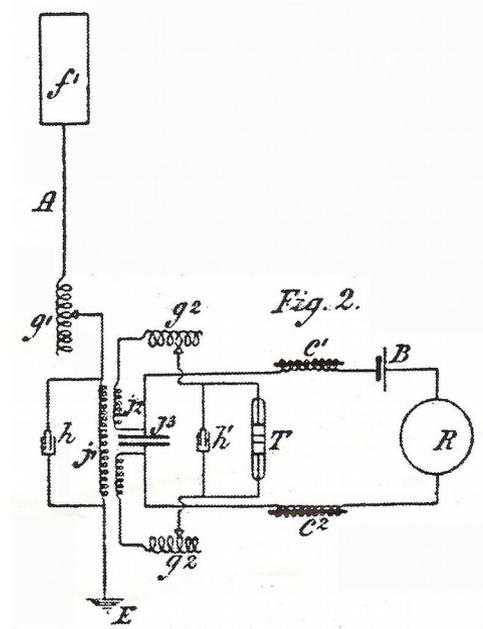
78,6 bilhões de
transistores

4 nm
(0,000000004 m)

**Pouco mais de um século de
engenharia eletrônica**

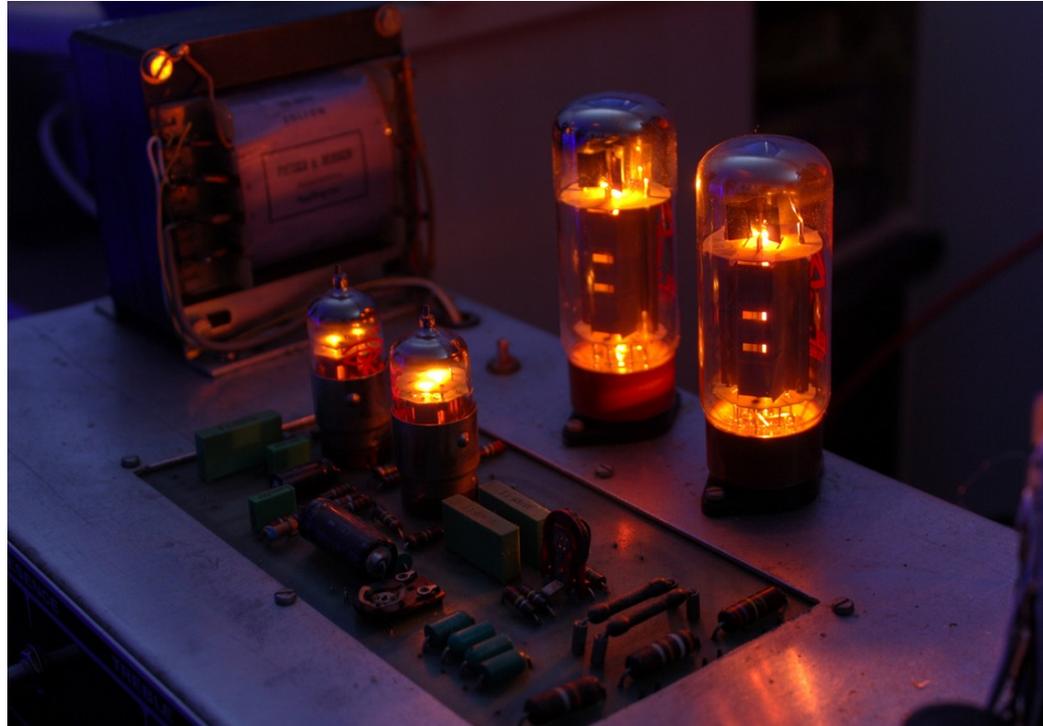
Telégrafo sem fio

- Marconi (~1900)



A invenção da válvula

- 1904 (Fleming)

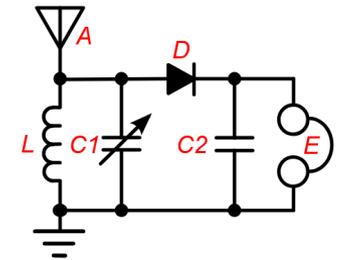


Rádio de galena

- ~1905

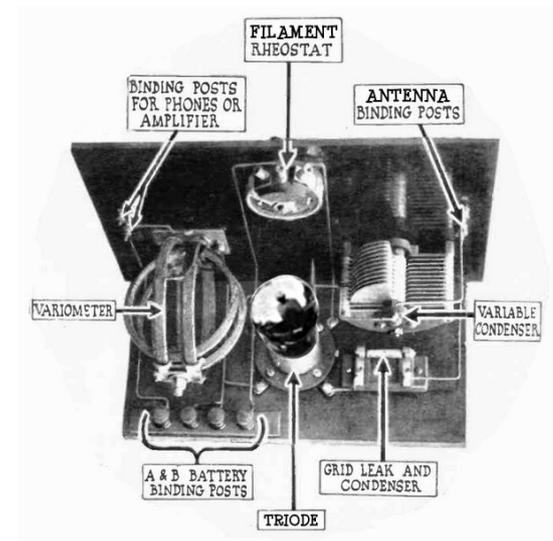
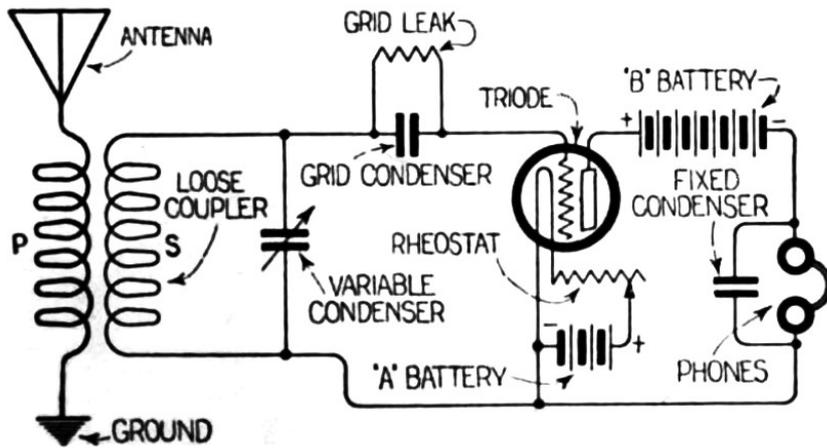


[https://en.wikipedia.org/wiki/Radio_receiver#/media/File:Kristallradio_\(3\).jpg](https://en.wikipedia.org/wiki/Radio_receiver#/media/File:Kristallradio_(3).jpg)



Rádios com válvulas

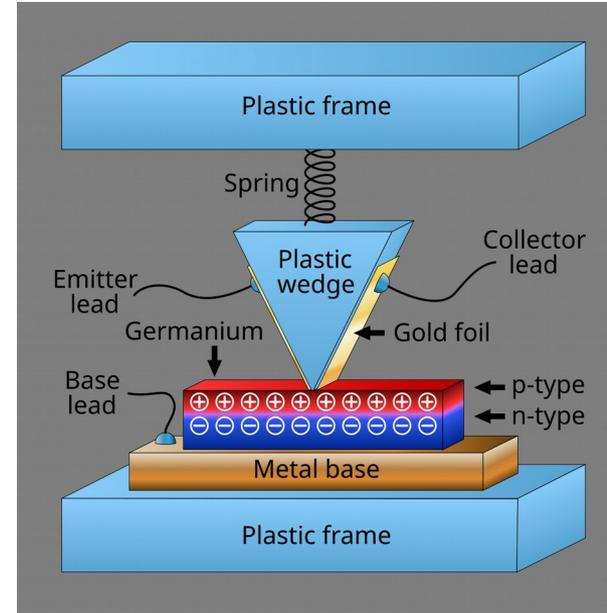
- ~1910



https://en.wikipedia.org/wiki/Radio_receiver

O transistor

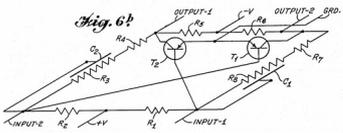
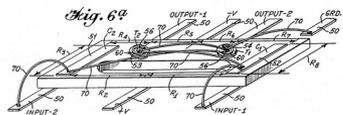
- 1947 (Bardeen, Brattain, Shockley)



O circuito integrado

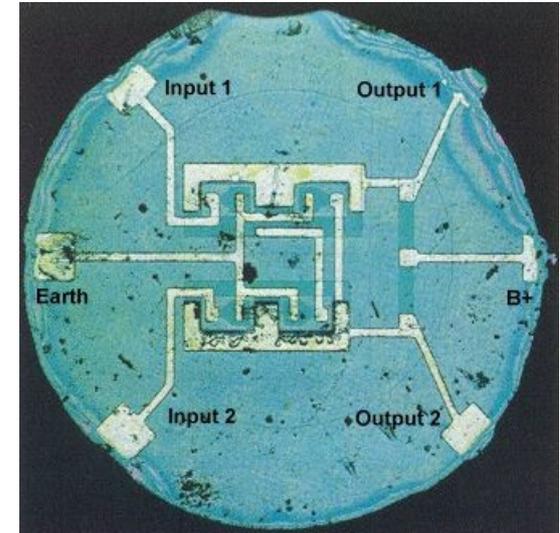
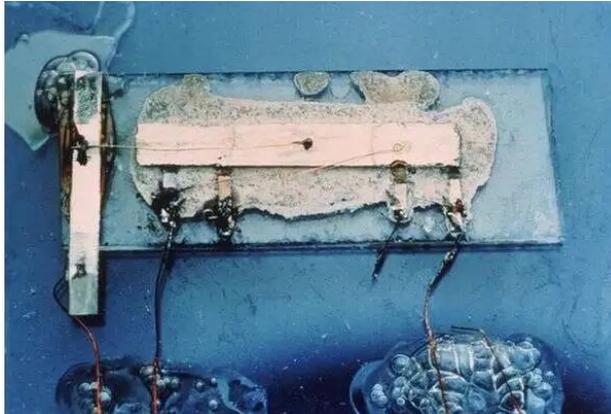
- 1958 (Kilby), 1959 (Noyce)

June 23, 1964 J. S. KILBY 3,138,743
MINIATURIZED ELECTRONIC CIRCUITS
Filed Feb. 6, 1959 4 Sheets-Sheet 2



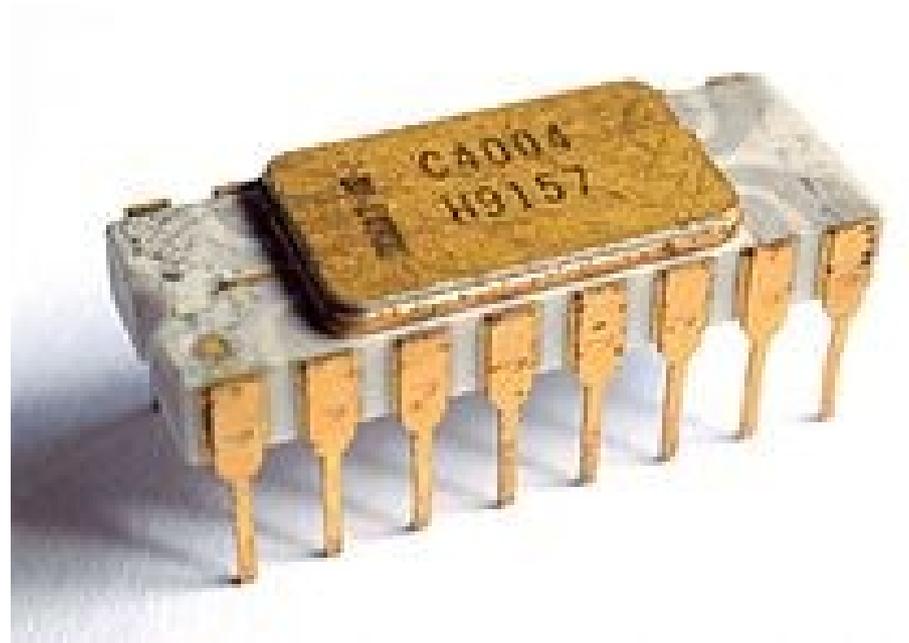
INVENTOR
Jack S. Kilby

BY *Lawrence Davis, William J. Brinkley*
ATTORNEYS



O microprocessador

- 1971 (4004 – Intel)
 - 2000 transistores
 - 10 μm



Rádio on-chip

- (~1975) TDA7000

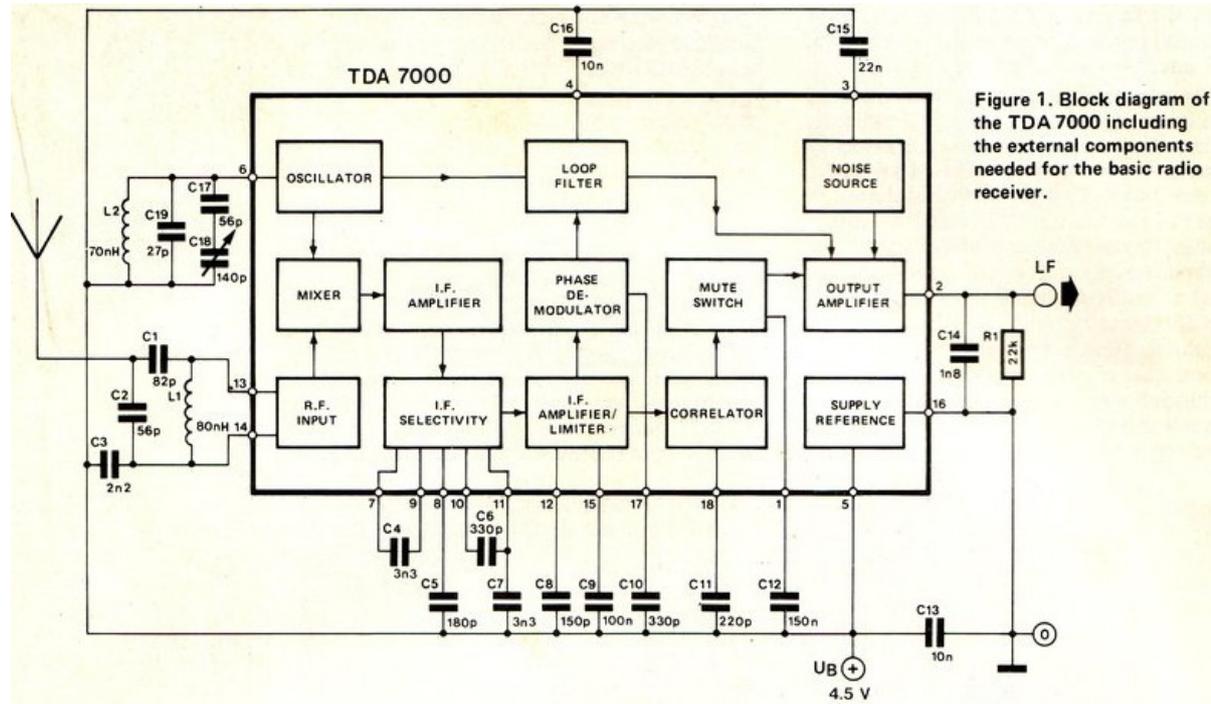
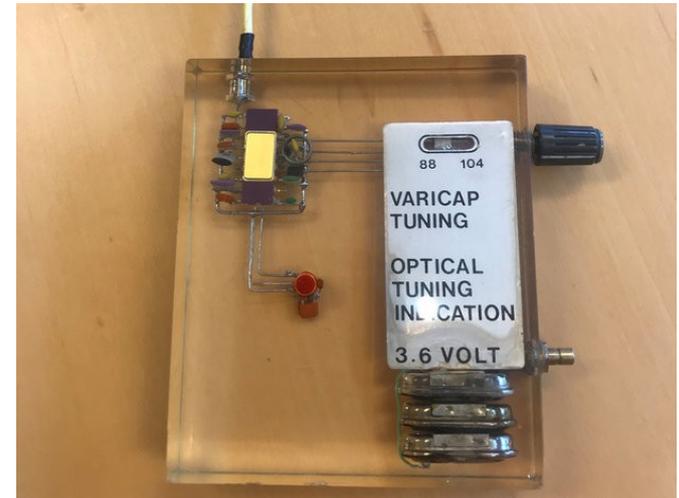


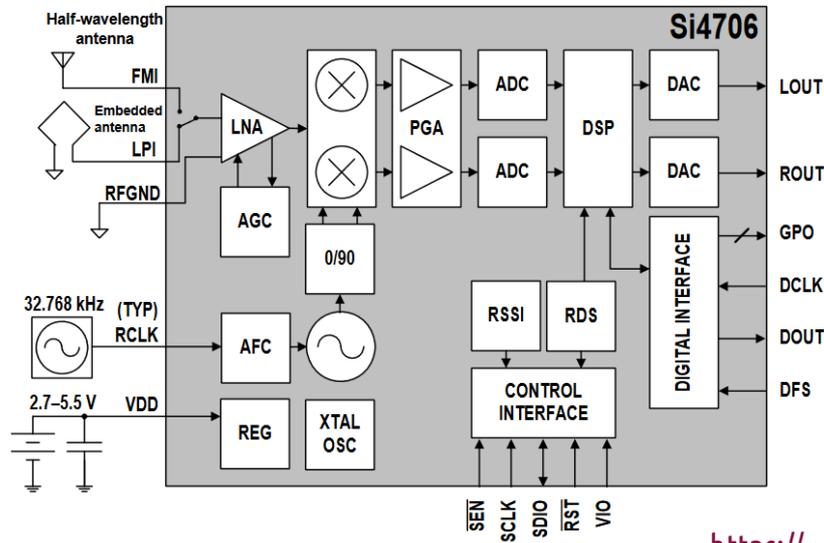
Figure 1. Block diagram of the TDA 7000 including the external components needed for the basic radio receiver.



<https://spectrum.ieee.org/chip-hall-of-fame-philips-tda7000-fm-receiver>

Rádio on-chip

- > 2010



<https://www.skyworksinc.com/-/media/SkyWorks/SL/documents/public/data-sheets/Si4706-C31.pdf>

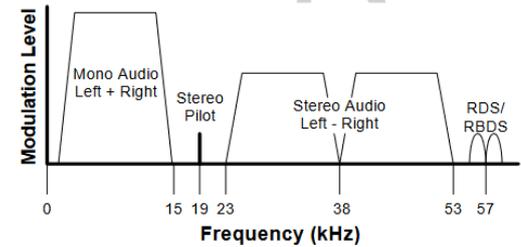
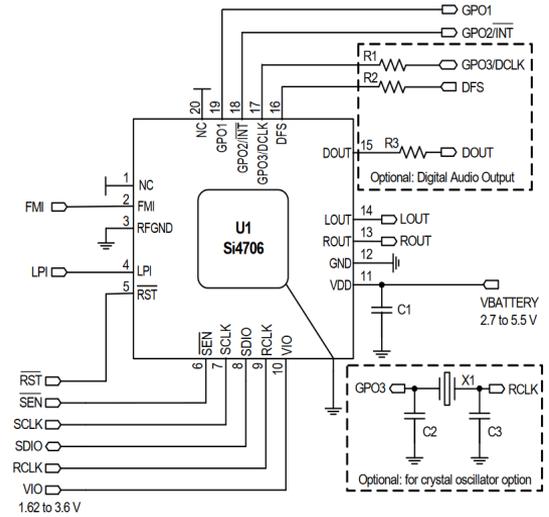
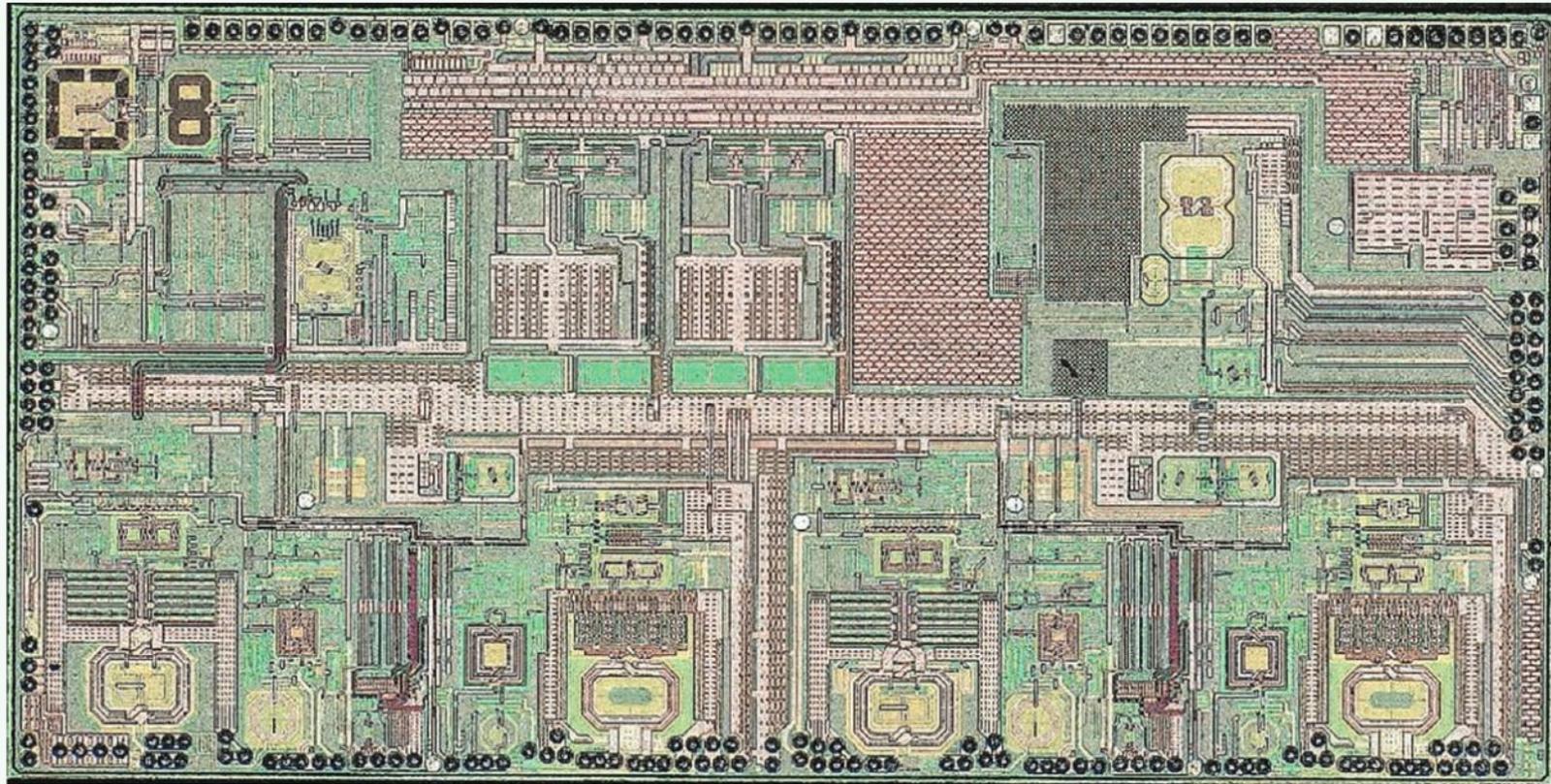


Figure 10. MPX Signal Spectrum

Chips dos “rádios” atuais



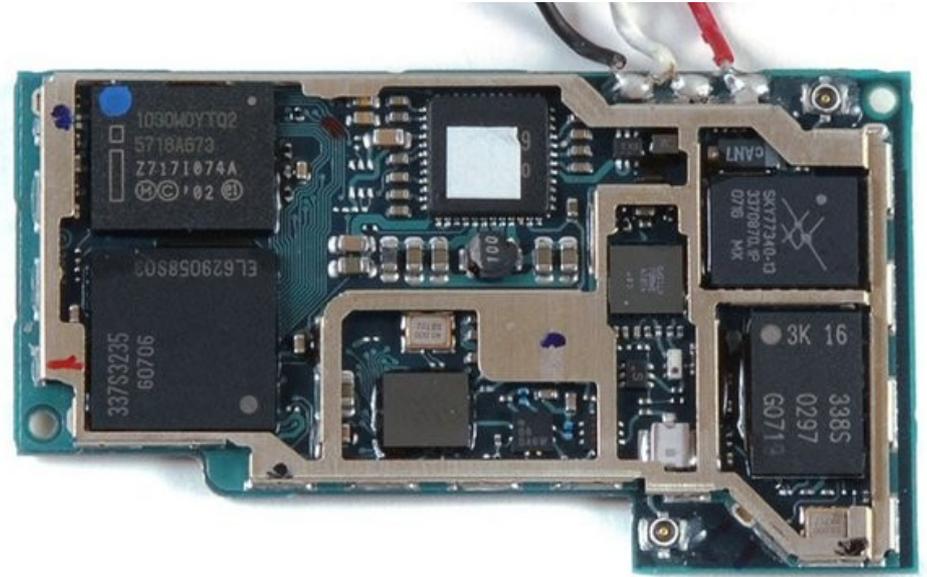
An example of a Wi-Fi/Bluetooth radio complexity.

Behzad Razavi

75 Years of RF Design

Smartphone

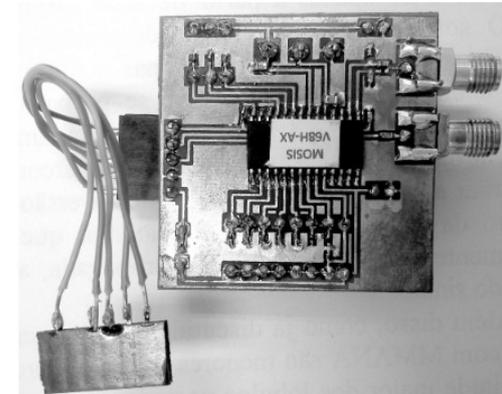
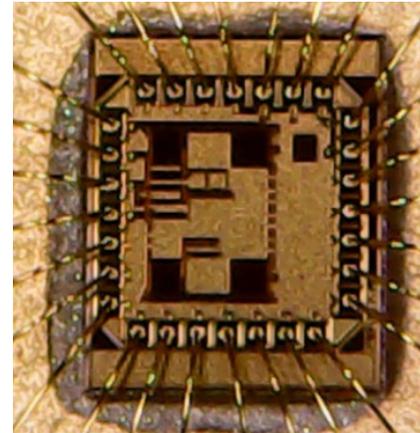
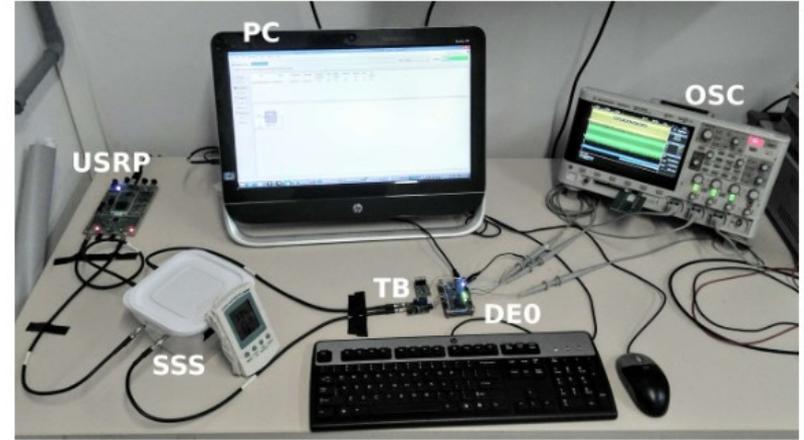
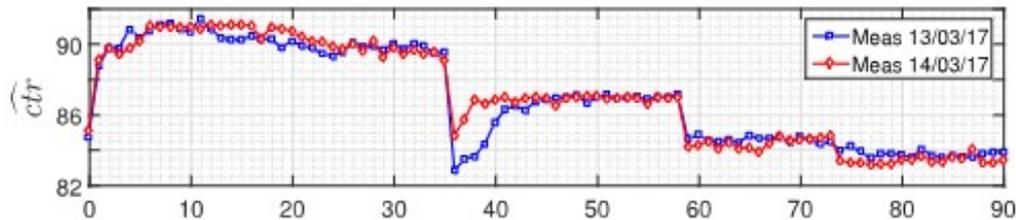
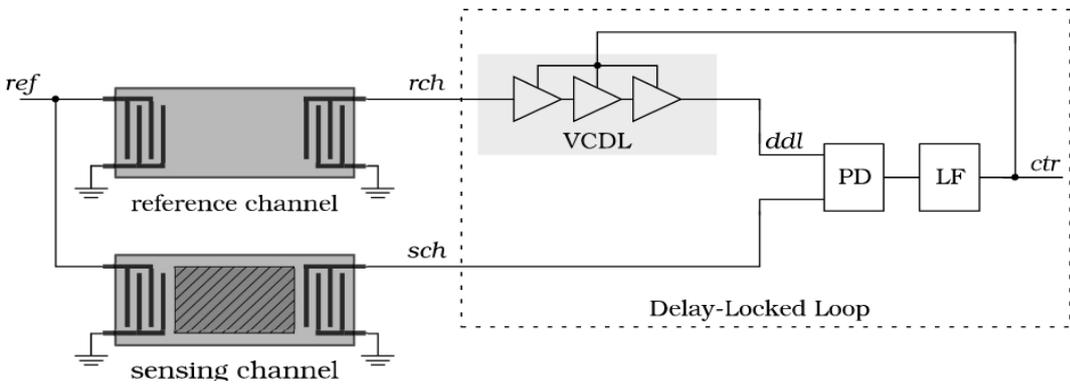
- 2007 (iphone)



Yes, we can!!

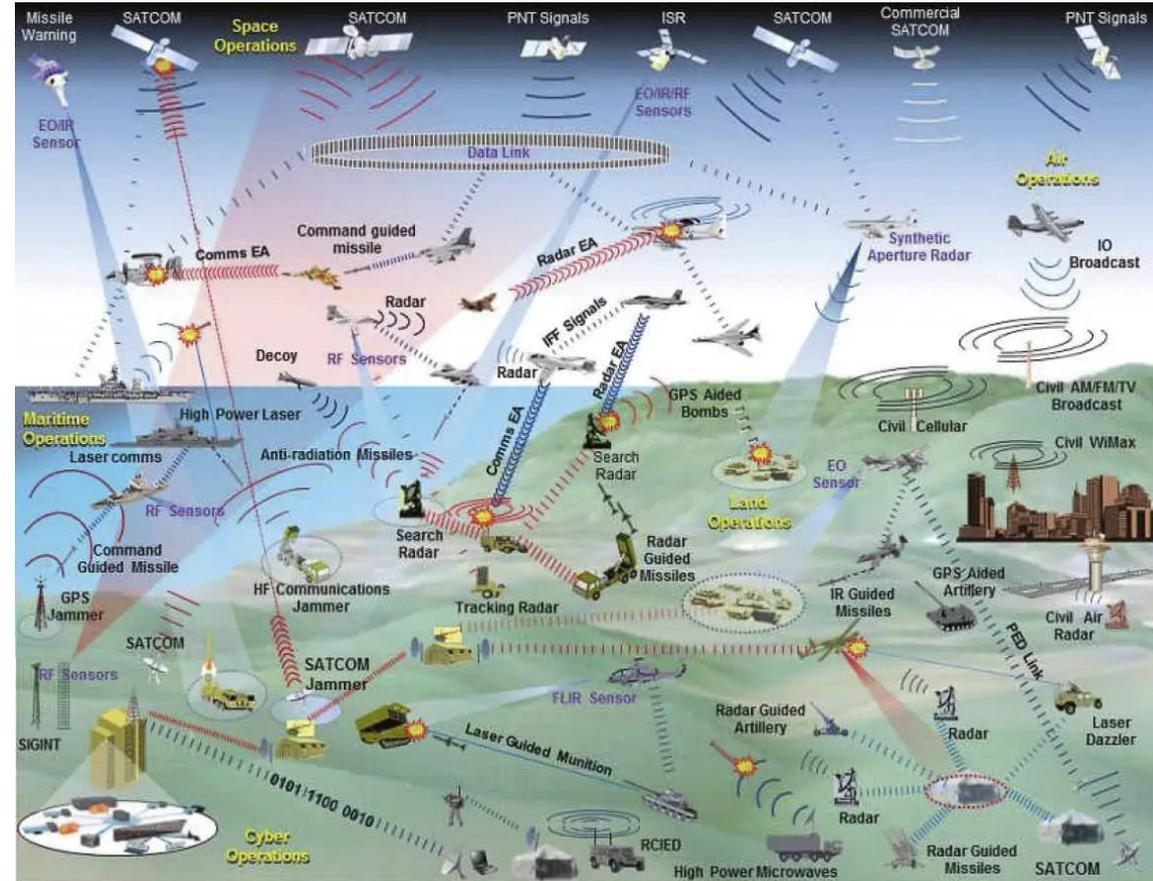
ANALYSIS AND DESIGN OF A CMOS DLL-BASED CONDITIONER FOR A SAW-DL RELATIVE HUMIDITY SENSOR

Rodrigo Eduardo Rottava

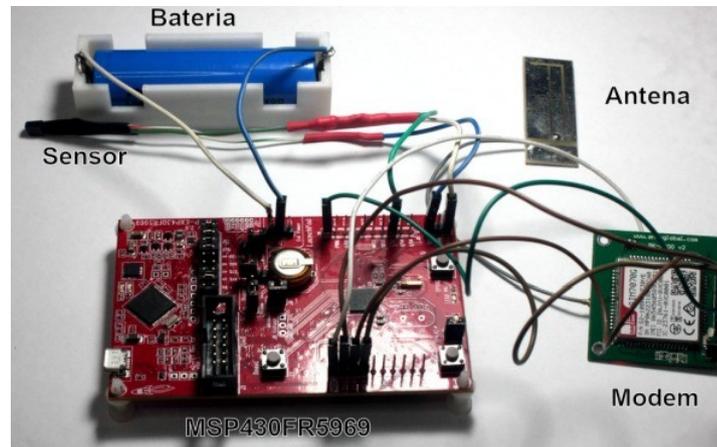
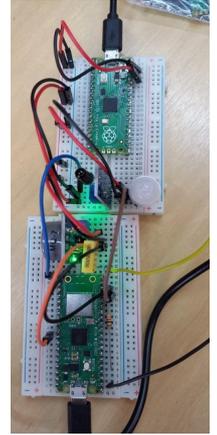
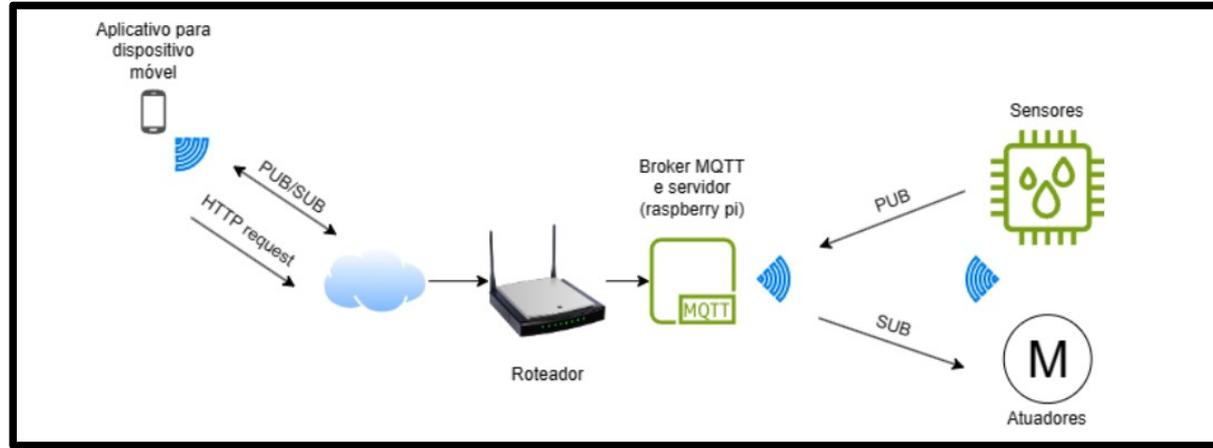


Atuação do Engenheiro Eletrônico

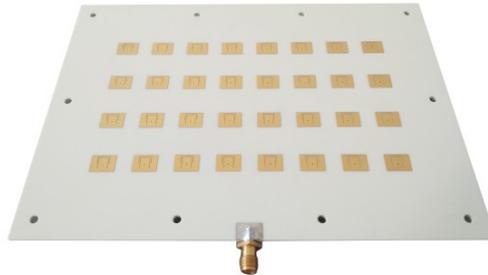
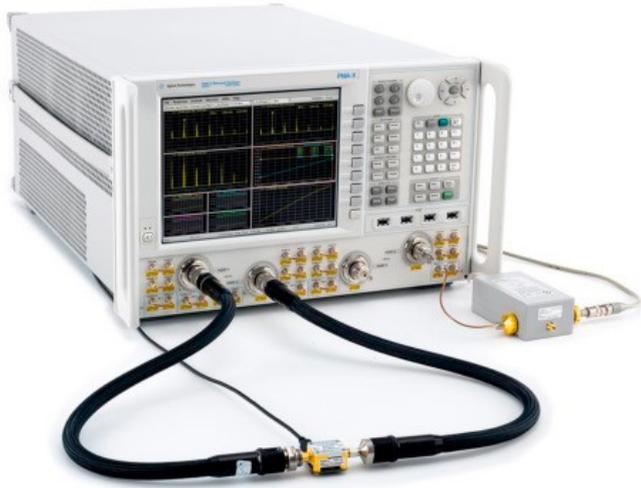
Sistemas eletrônicos



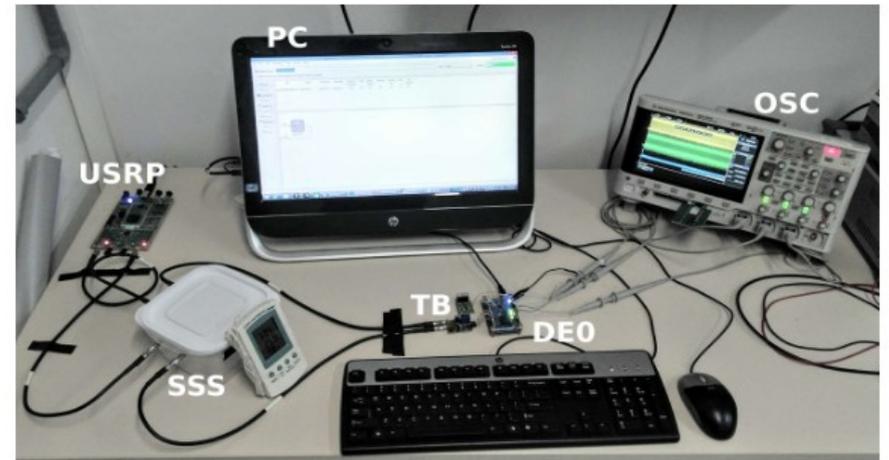
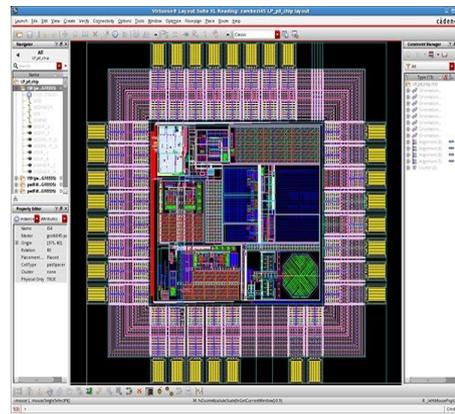
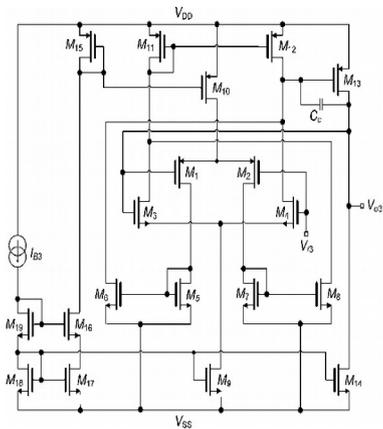
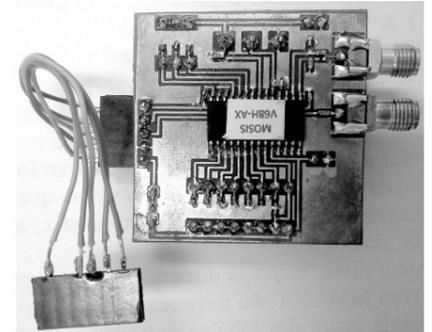
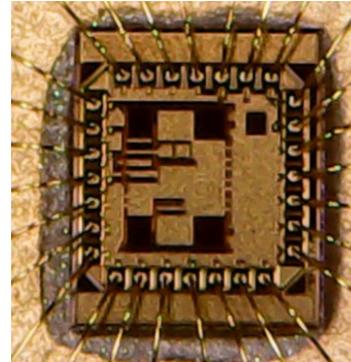
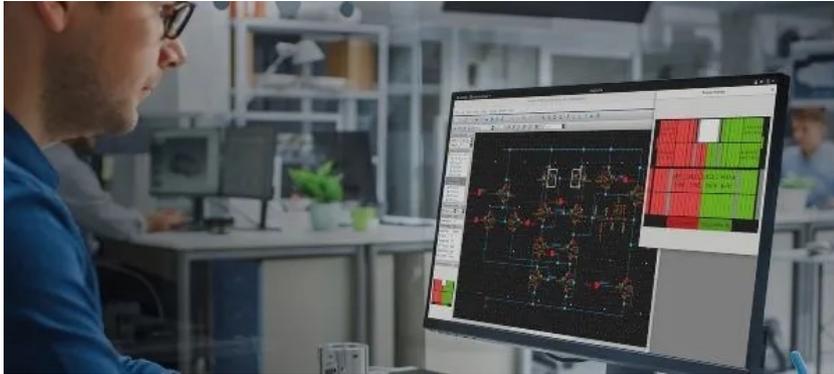
IoT (Internet dos Objetos)



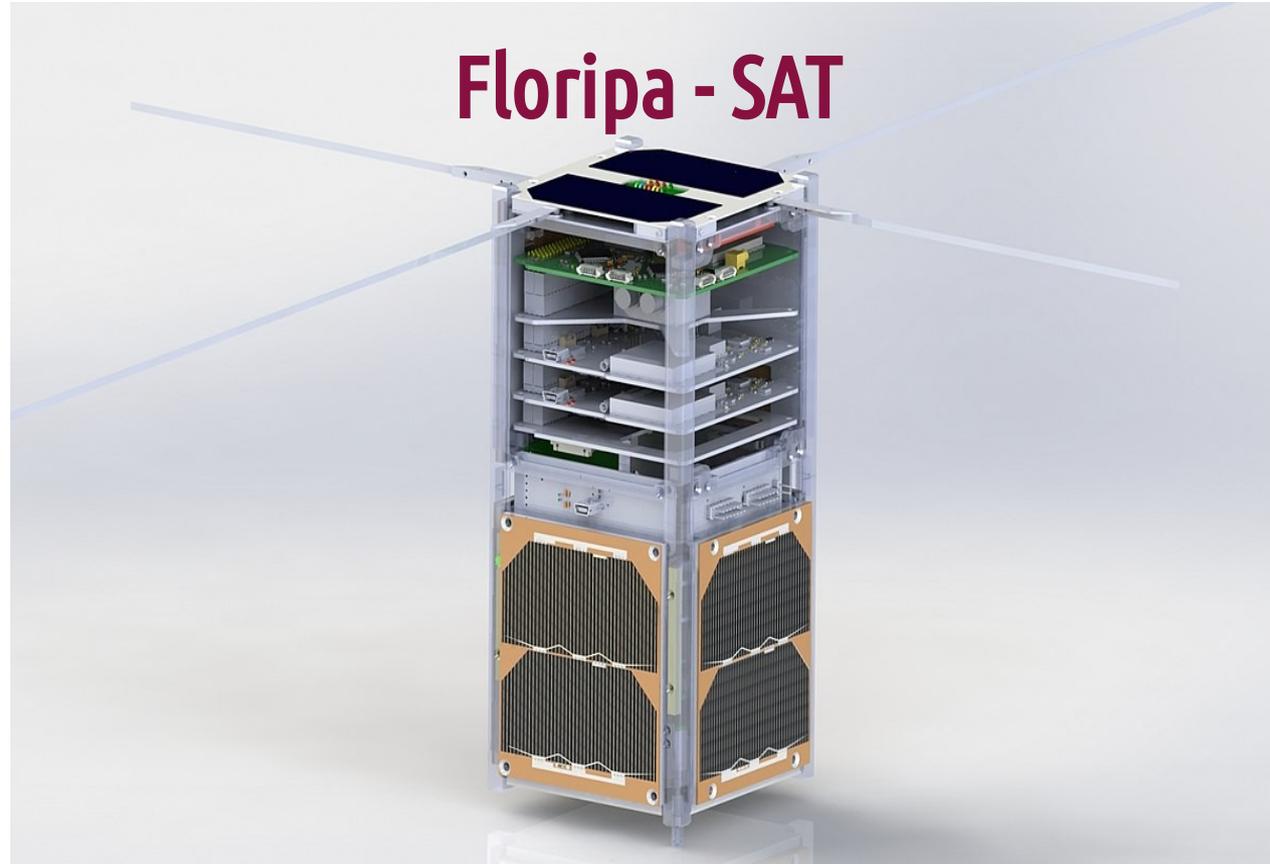
Telecomunicações



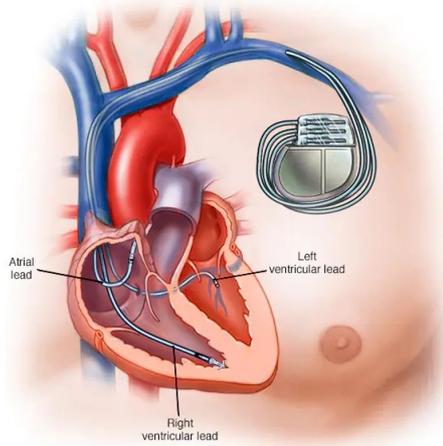
IC design



Aplicações espaciais



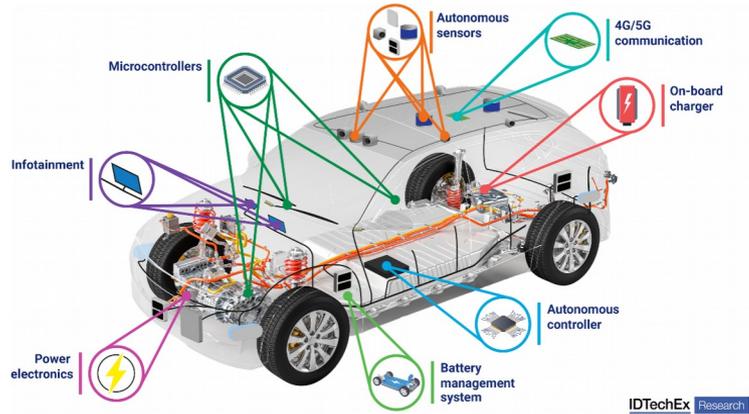
Sistemas biomédicos



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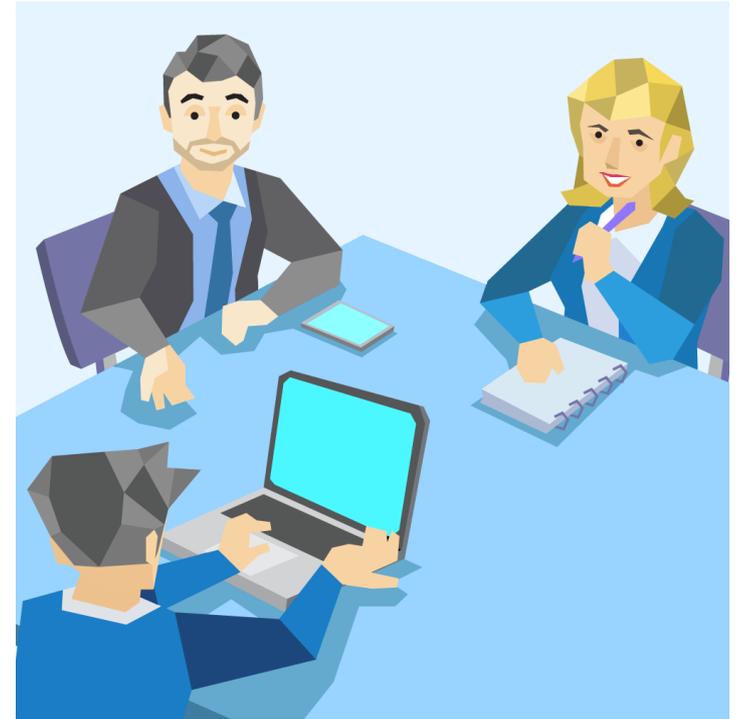


Mobilidade



Outras Atividades

- Agências reguladoras (ANATEL, ANEEL, etc.)
- Consultorias
- Mercado financeiro
- Gestão de empresas
- Pesquisa
- Ensino



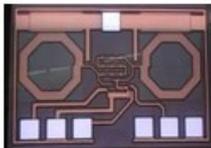
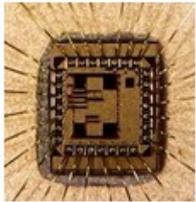
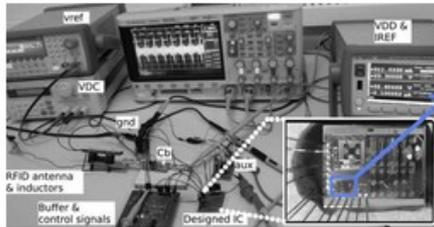
UFSC

Características do curso

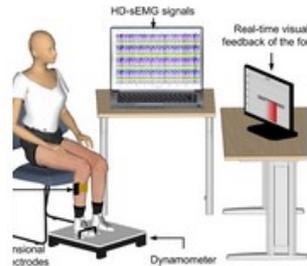
- Entrada de 30 alunos por semestre (Vestibular + SISU)
- 300 alunos matriculados
- Conclusão em 5 anos
- Estágio obrigatório + Trabalho de conclusão de curso
- Corpo docente de alto nível (professores doutores/pesquisadores)
- Forte integração com atividades de pesquisa e extensão
- Intercâmbios com universidades no exterior

Áreas de especialização

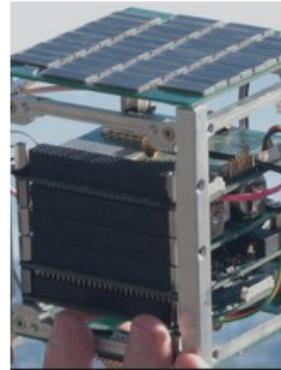
Sistemas Eletrônicos



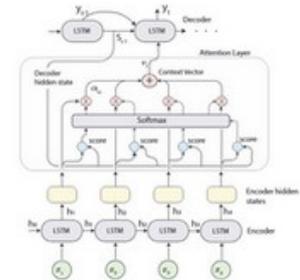
Engenharia Biomédica



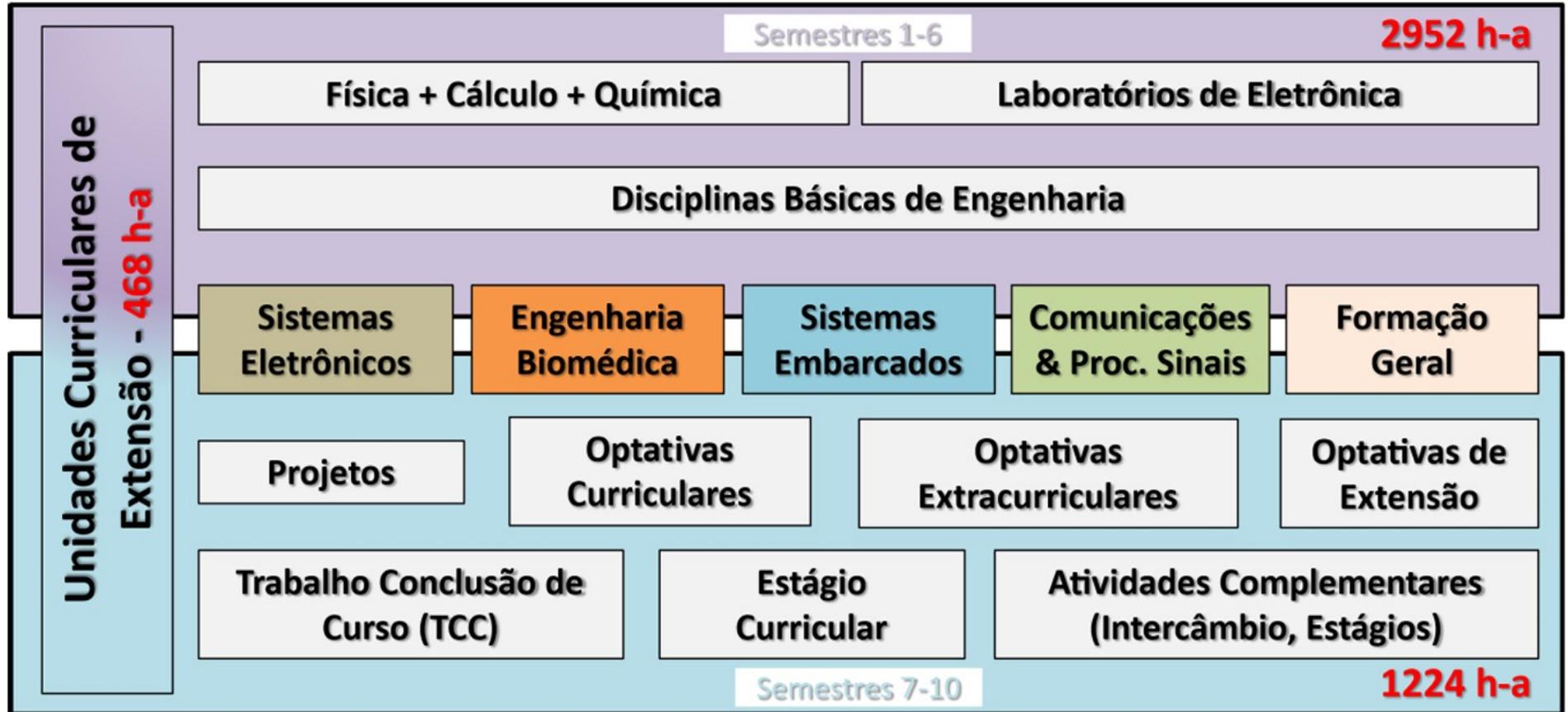
Sistemas Embarcados



Telecom Processamento de sinais

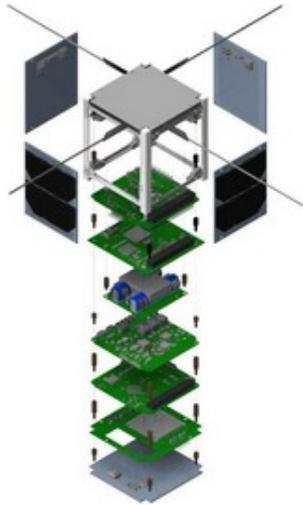


Estrutura do curso



Soft Skills

**Projetos com estudantes,
Iniciação científica nos
laboratórios**



FloripaSAT,...

**Equipes de
competição**



Ampera, Baja, Vento Sul, ...

**Iniciativas
estudantis**



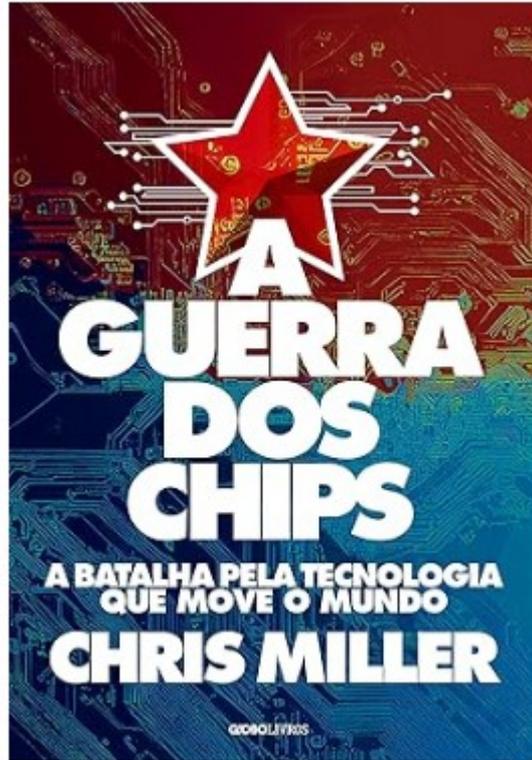
Empresas Jr., ...

Mercado

- O engenheiro eletrônico tem **amplo** mercado de trabalho
- Dispõe de oportunidades locais, nacionais e internacionais
- Pode **empreender** facilmente
- Atuar em **pesquisa**



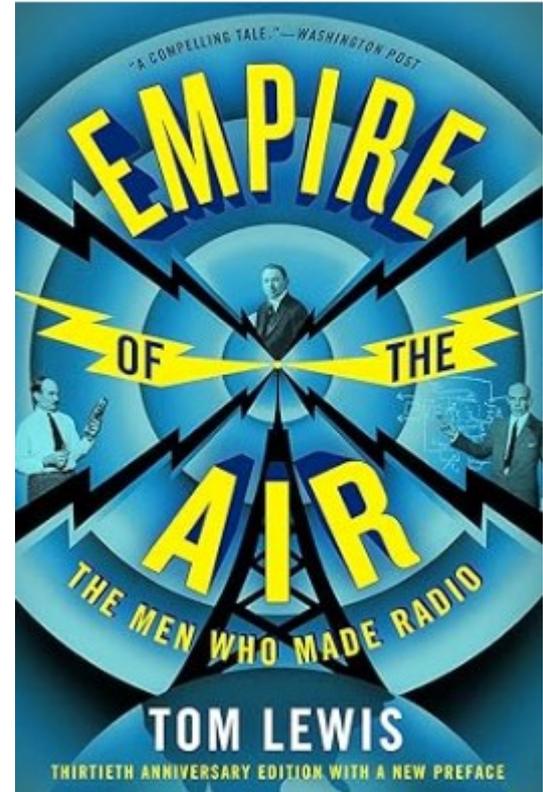
Sugestão: Ler



MATERIAL WORLD

air
oil
sand
THE SIX RAW MATERIALS THAT SHAPE
MODERN CIVILIZATION

ED
COPPER
CONWAY



Egressos



Celso Martines Leite

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Affiliation

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Research and Development Manager
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Obrigado!

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<http://geltro.ufsc.br>

