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Hybrid Ring or Rat
Race Coupler in

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Microwave
Engineering by
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Designs
Simulation of 180
degree ring hybrid
coupler using HFSS
at 2.4 GHz by Dr.
Niraj Kumar Hybrid
Rings Rat Race
Circuits -
Microwave
Components -
Microwave

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Hybrid Type Rat

How to design Rate

Race Coupler

Designs
Race coupler or

hybrid coupler full

tutorial. Week

4-Lecture 20

Design and

simulation of branch

line (90 degree)

coupler using HFSS

by Dr. Niraj Kumar

VIT Chennai Hybrid

~~Ring Coupler, Part I~~

Even-odd mode

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analysis of 180 degree hybrid coupler/ Rat race coupler and its S-parameters design and simulation of 180 hybrid coupler using ADS Hybrid Ring Coupler, Part III Lecture -- The 180 Degree Hybrid Directional Coupler

~~Passive component~~
~~Rat Race Coupler~~

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Cathie Wood on Rat
Tesla, the Election,
and Innovation (Ep.
174) Top

tip#4.....Rats vs

ASF rats #158:

Directional Coupler

Basics \u0026amp; how

to sweep SWR of an

antenna | Return

Loss | VSWR

Observations E3:

Comparing Different

Levels of Hybrid

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Hybrid Type Rat

coupling (cis) vs
Repulsion (trans)

Directional Coupler

Characteristics IM

A RAT! Microstrip

Ring Resonator

Design Guide in

HFSS 15 ~~Design of~~

~~a microstrip~~

~~branchline coupler~~

~~on CST RF and~~

~~Microwave PCB~~

~~Design - Part 5:~~

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Couplers Hybrid
Ring or Rat race
junction

Microwave

Engineering UNIT

∇ Directional

Couplers and

Hybrid Junctions:

Magic T Hybrid

Ring Coupler, Part

II

180 deg. Hybrid

Addition and

Subtraction

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Branch line coupler
and hybrid ring
coupler

Hybrid Ring R A T
R A C E H Y B R I D
R I N G | I N M W E
| T E L U G U R F a n d
M i c r o w a v e P C B
D e s i g n - P a r t 4:
P o w e r D i v i d e r s.

Hybrid Type Rat
Race Coupler
A rat-race coupler,
also known as a

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Hybrid ring coupler, is a type of coupler used in RF and microwave systems. In its simplest form, it is a 3 dB coupler and is thus an alternative to a magic tee.

Compared to the magic tee, it has the advantage of being easy to realize in

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planar technologies such as microstrip and stripline, although waveguide rat races are also practical. Unlike magic tees ...

Rat-race coupler -
Wikipedia

A 180° Ring
Hybrid (Rat-Race
Coupler) is a four-

Where To Download

port network with
180 ° phase
difference between
two ports. It is
cheaper to
manufacture this
type of microstrip
line component
compared to a wave
guide 180 ° hybrid
junction, so called
magic-T. The
objective of this
model is to compute

Where To Download

the S-parameters
and to observe the
matching, isolation,
and coupling around
the operating
frequency ...

Rat-Race Coupler

Abstract: Two
reduced size hybrid
type rat-race
coupler designs are
presented. By using

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Two kinds of T-type equivalent circuits replaced the transmission lines used in rat-race coupler and employing the coupled line structure, we achieved reduce size rat-race designs. Two prototypes designed at

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2.45GHz are
designed, simulated,
fabricated on FR4
substrate and
measured. The
simulated and ...

Hybrid type rat-
race coupler
designs - IEEE
Conference ...

Two reduced size
hybrid type rat-race

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Hybrid designs are presented. By using two kinds of T-type equivalent circuits replaced the transmission lines used in rat-race coupler and employing the ...

Hybrid type rat-race coupler designs -

Where To Download

ResearchGate Rat

The hybrid ring
Race Coupler
Designs
coupler, also called
the rat-race

coupler, is a four-
port 3 dB

directional coupler
consisting of a

$3\sqrt{2}$ ring of

transmission line

with four lines at

the intervals shown

in figure 12. Power

input at port 1 splits

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and travels both ways round the ring. At ports 2 and 3 the signal arrives in phase and adds whereas at port 4 it is out of phase and cancels. Ports 2 and 3 are in ...

Power dividers and
directional couplers
- Wikipedia

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For an equal-split rat-race coupler, the impedance of the entire ring is fixed at $1.41 \times Z_0$, or 70.7 ohms for a 50 ohm system. For an input signal V_{in} , the outputs at ports 2 and 4 (thanks, Tom!) are equal in magnitude, but 180 degrees out of phase. Rat-race

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Race Coupler
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coupler (equal
power split) Note:
Richard from
Australia reminded
us recently that the
rat-race can also be
used as an in-phase
splitter ...

Microwaves101 |
Rat-race couplers
3dB, 180 ° Hybrid
Ring Couplers

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180° hybrid ring
couplers (also
called “rat race”
couplers) are four-
port devices used
to either equally
split an input signal
or to sum two
combined signals.
An additional
benefit of the
hybrid ring is to
alternately provide
equally-split but

Where To Download

180 degree phase-
shifted output
signals.

Designs

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Hybrid Coupler
Basics - MECA
Electronics, Inc.

A rat-race coupler
is a circular device
often used to split
or combine radio
frequency and
microwave signals.

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The size of the conductor ring in the coupler is typically equal to one-and-a-half wavelengths, and there are four ports that are separated by 90° . Output signals sometimes undergo a phase-shift of 180° , meaning the waveform on a

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graph will shift a
certain distance
based on the size ...
Designs

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What Is a Rat-Race
Coupler? (with
picture)

6.9 Rat Race
Coupler. Just like
the branchline
coupler, the rat
race coupler is a
four-port network

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with equal power-
split between the
two output
ports. Figure 6.40
shows—as an
example—a rat race
coupler in
microstrip
technology with
corresponding line
lengths and
characteristic
impedances. The
annular

Where To Download Arrangement of Rat Race Coupler Designs Impedances of .

6.9 Rat Race
Coupler - RF and
Microwave
Engineering ...
180 degree hybrid
couplers. These
include rat-race

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Hybrid Type Rat
Race Coupler
Designs
Apr 16 2015

couplers and
waveguide magic
tees. Here we will
look at the rat-race
and introduce the
vector and
shorthand notation
that is often used
when referring to
180 degree hybrid
couplers. In the
figures, the skinny
lines have
impedance $1.41 \times Z_0$.

Where To Download

Let's look at the S-parameters of a "classic" rat-race ...

Apemc2015

Microwaves101 |
Hybrid (3 dB)
couplers
hybrid and the rat-
race couplers,
respectively, a
frequency tuning
behavior ranging
between 0.8-1.3

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GHz is obtained. Moreover, it is proven that odd harmonics up to the 5th harmonic are efficiently suppressed. The results from two different numerical full-wave EM simulations using IE3D and HFSS verify the underlying

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principle. Index
Terms - 3 dB
hybrid coupler,
capacitively-loaded
transmission ...

Compact Tunable 3
dB Hybrid and Rat-
Race Couplers with

...

In this letter, an
investigation of a
novel compact rat-

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A hybrid coupler incorporating a U-type defected ground structure (UDGS) is presented. Served by this microstrip electromagnetic band gap element (MEBE) technology, the size of the coupler is reduced due to its slow-wave effect

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and its band-stop
effect enables
strong high-order
harmonics
rejection. In the
meantime, the
measured ...

RF RAT-RACE
COUPLERS WITH
U-TYPE DGS
MICROSTRIP ...

This work presents

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a simplified
approach in which
the sum and
difference of the
received signals
using a hybrid rat
race (HRR) coupler
forms the basis for
the estimation of
AOA. A 2×1
array ...

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ResearchGate
How to design Rate
Race coupler or
hybrid coupler full
tutorial. How to
design Rate Race
coupler or hybrid
coupler in CST.
How to design Rate
Race coupler or...

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Race coupler or Rat
hybrid coupler full
Race Coupler

Our hybrid couplers
reliably combine or
split the high power
levels seen in
scientific,
commercial and
military devices.

We manufacture our
3 dB 90 ° air-
dielectric
transmission line

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couplers in a
variety of
configurations and
bandwidths. Mega
Hybrids can be
constructed in both
Stripline and Rat
Race topologies.
Electrical
specifications for
quarter-wave units
over a 10%
bandwidth are as
follows:

Where To Download Hybrid Type Rat Race Coupler Coaxial Hybrid Couplers | Mega Industries |

Stripline ...
performance are
being required in
large quantities. Rat-
race coupler, also
referred as hybrid
ring coupler, is one
type of key passive
components for

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various microwave applications, such as mixers, power amplifiers, phase shifters and antenna feeding networks.

This is Received 20
March 2011,
Accepted 14 April
2011, Scheduled 15
April 2011

A COMPACT

Page 40/99

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MICROSTRIP RAT-
RACE COUPLER
WITH MODIFIED
LANGE ...

L.Z. Zheng et al.,
Hybrid type rat-
race coupler
designs, in
Proceedings of
IEEE Asia-Pacific
Symposium on
Electromagnetic
Compatibility
(APEMC), Taipei

Where To Download

(2014), pp.

724 – 727. 56. S.

Koziel, A.

Bekasiewicz, Novel

structure and size-

reduction-oriented

design of microstrip

compact rat-race

coupler, in

Proceedings of

IEEE/ACES

International

Conference on

Wireless

Where To Download Information Hybrid Type Rat Technology and Race Coupler Systems ... Designs

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Angle of arrival
estimation using
hybrid rat race
coupler ...

In the bottom half
of the hybrid ring
P1 and P4 ports are
 $3^* / 4$ wavelengths
away from each

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other. The power fed at the port-1 is splitted across port-2 and port-4 where as port-3 is completely isolated. Rat Race Coupler S-Matrix | Rat Race Coupler Applications. The Rat Race Coupler S-matrix is as follows. It can be used in following ...

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This book presents the proceedings of the International Virtual Conference on Industry 4.0 (IVCI4.0 2020). This conference brings together specialists from the academia and industry sectors to

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promote the exchange of knowledge, ideas, and information on the latest developments and applied technologies in the field of Industry 4.0. The book discusses a wide range of topics such as the design of smart and intelligent products,

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developments in
recent technologies,
rapid prototyping
and reverse
engineering,
multistage
manufacturing
processes,
manufacturing
automation in the
Industry 4.0 model,
cloud-based
products, and cyber-
physical and

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reconfigurable
systems, etc. The
volume supports
the transfer of vital
knowledge to the
next generation of
academics and
practitioners.

This book includes
novel and state-of-
the-art research
discussions that
articulate and

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report all research aspects, including theoretical and experimental prototypes and applications that incorporate sustainability into emerging applications. In recent years, sustainability and information and communication

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technologies (ICT) are highly intertwined, where sustainability resources and its management has attracted various researchers, stakeholders, and industrialists. The energy-efficient communication technologies have revolutionized the

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various smart applications like smart cities, healthcare, entertainment, and business. The book discusses and articulates emerging challenges in significantly reducing the energy consumption of communication

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systems and also explains development of a sustainable and energy-efficient mobile and wireless communication network. It includes best selected high-quality conference papers in different fields such as internet of things, cloud computing,

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data mining, type Rat
artificial
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intelligence,
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machine learning,
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autonomous
systems, deep
learning, neural
networks,
renewable energy
sources, sustainable
wireless
communication
networks, QoS,
network

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sustainability, and
many other related
areas.

Microwave

Engineering is
intended as
textbook catering
needs of third year
undergraduate
students of
Electronics &
Communication
Engineering.

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Engineering is a
prerequisite for
courses like Radar
Systems,
Microwave
Integrated Circuits
and Satellite
Communications.

This book
addresses the
fundamentals and
practical

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Implementations of
antennas for Global
Navigation Satellite
Systems (GNSS) In
this book, the
authors discuss the
various aspects of
GNSS antennas,
including
fundamentals of
GNSS, design
approaches for the
GNSS terminal and
satellite antennas,

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performance enhancement techniques and effects of user ' s presence and surrounding environment on these antennas. In addition, the book will provide the reader with an insight into the most important aspects of the

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GNSS antenna Rat
technology and lay
the foundations for
future

advancements. It
also includes a
number of real case
studies describing
the ways in which
antenna design can
be adapted to
conform to the
design constraints
of practical user

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devices, and also the management of potential adverse interactions between the antenna and its platform. Key Features: Covers the fundamentals and practical implementations of antennas for Global Navigation Satellite Systems (GNSS)

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Describes technological advancements for GPS, Glonass, Galileo and Compass Aims to address future issues such as multipath interference, in building operation, RF interference in mobile Includes a number of real case

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studies to illustrate
practical
implementation of
GNSS This book
will be an invaluable
guide for antenna
designers, system
engineers,
researchers for
GNSS systems and
postgraduate
students (antennas,
satellite
communication

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technology). R&D engineers in mobile handset manufacturers, spectrum engineers will also find this book of interest.

This book deals with microwave electronics, that is to say those components of microwave circuits

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that generate, amplify, detect or modulate signals. It is based on a course given in the Electrical Engineering Department of Eindhoven University since 1985 and on about twenty years of experience in the microwave field.

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Somewhat to my surprise I found that there were hardly any textbooks that addressed the specific properties and demands of microwave devices, including vacuum devices and their interactions with circuits. Numerous books exist on

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electronic devices,
Race Coupler
Dezigns
Apert 2015
dealing in an
excellent way with
the basic device
physics, but being
somewhat brief on
typical micro wave
aspects. On the
other hand there
are also many
books that
concentrate on
electromagnetic

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theory and passive
circuits, treating
devices without
reference to the
underlying physics.

In between there
are some entirely
devoted to a
particular device,
for example, the
GaAs MESFET.

With regard to
tubes the situation
is even worse:

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books that treat the basic principles are usually quite old and modern books often concentrate on specific devices, like high power tubes. So it seems that there is room for a book like this one. Its aim is to provide an elementary understanding

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of microwave
electronic devices,
both vacuum and
semiconductor, on
the one hand in
relation to the basic
physics underlying
their operation and
on the other in
relation to their
circuit applications.

Metamaterials have
become one of the

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most important
emerging
technologies in the
scientific
community due to
its unusual
electromagnetic
properties.

Consequently,
during the last
years, a huge deal
of efforts has been
concentrated in
order to design

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components and devices based on metamaterials for many potential applications. The main objective of this book is to present in-depth analysis of the theory, properties, and realizations of novel devices that could be integrated

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within modern and
future
communication
systems. The book
contains 11
chapters written by
acknowledged
experts,
researchers,
academics, and
microwave
engineers,
providing
comprehensive

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Information and
covering a wide
range of topics on
several aspects of
microwaves and
optics, including
polarization
conversion,
asymmetric
transmission,
transmission lines,
filters, plasmonic
lenses, tunable
metamaterials, light

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manipulation, absorbers, and antennas, among others. This book is suitable for scholars from large scientific domain and therefore given to engineers, scientists, graduates, and other interested professionals as a reference on these

Where To Download Artificial Materials of tomorrow.

This thoroughly revised and updated edition, while retaining the major contents of the previous edition, presents the latest information on the various aspects of microwave engineering. With

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Improved Type Rat
organization and
enriched contents,
the book explores
expanded and
updated information
on the basic
principles,
characteristics and
applications of
commonly used
devices in the
design of various
microwave

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systems. The book commences with a discussion on microwave basics, EM wave theory, transmission line theory, hollow pipe waveguides, microwave junctions and goes on to provide in-depth coverage of waveguide components,

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magnetrons and
TWTs. The book
focuses on the solid-
state devices and
microwave
measurements as
well. The book has
an added advantage
of exercise section
involving essay
type questions,
exercise problems,
fill in the blanks,

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Match the following and multiple choice questions, designed to reinforce the students' understanding of the concepts. This tailor-made book is appropriate for the undergraduate and postgraduate students of electronics and communication

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Highlights of the
Race Coupler
Second Edition •
Designs

Two new chapters,
Apex 2015
namely, Klystrons,
and Magnetrons and
TWTs are
incorporated into
the book. • Several
sections like coaxial
line analysis,
microwave link
analysis, microwave
bench design,

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measurement of
phase shift,
measurement of
dielectric constant,
and network
analyzers have
been introduced
into the book. •
Numerous
questions and
solved problems
have been added to
the exercise section
of each chapter.

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As man turns his attention from the overcrowded continents of this planet and explores the spaciousness of the ocean, the applications of ocean acoustics become increasingly numerous and important. This

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Hybrid provides an up-to-date introduction to the theory of sound propagation in the ocean, with much new material having been added throughout the second edition. It includes both ray and wave treatments and considerable

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attention is paid to stochastic problems such as the scattering of sound at rough surfaces and random inhomogeneties. An introductory chapter that discusses the basic experimental data complements the following theoretical

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RF and Microwaves
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is currently in the
forefront as a
fundamental
technology in
numerous industrial
and commercial
applications. As
applications of RF
and microwaves
continue to evolve
and as this

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technology becomes a common factor in the scientific and engineering communities it is imperative that university students and practicing scientists and engineers become thoroughly familiar with the measurement

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principles,
electronics, and
design

fundamentals

underlying this

technology. RF and

Microwaves is

currently in the

forefront as a

fundamental

technology in

numerous industrial

and commercial

applications. As

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applications of RF
and microwaves
continue to evolve
and as this
technology
becomes a common
factor in the
scientific and
engineering
communities it is
imperative that
university students
and practicing
scientists and

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engineers become
thoroughly familiar
with the
measurement
principles,
electronics, and
design
fundamentals
underlying this
technology.

Advanced RF &
Microwave Circuit
Design is the
quickest way to

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master this powerful subject, and information contained within the pages of this book will make every key electronic, measurement, and design principle you need a simple task. The book introduces concepts on a wide range of materials and has

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Several advantages over existing texts, including: 1. The presentation of a series of scientific postulates and axioms, which lays the foundation for any of the engineering sciences and is unique to this book compared with similar RF and

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Microwave texts. 2.

The presentation of classical laws and principles of electricity and magnetism, all inter-related, conceptually and graphically. 3.

There is a shift of emphasis from rigorous mathematical solutions of Maxwell's

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equations, and instead has been aptly placed on simple yet fundamental concepts that underlie these equations. This shift of emphasis will promote a deeper understanding of the electronics, particularly at

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RF/Microwave Rat

frequencies. 4.

Fundamentals of

electronics have

been amply treated,

which makes an

easy transition to

RF/Microwave

principles and

prevents a gap of

knowledge in the

reader's mind.

This book gathers

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papers presented at
the 22nd
International
Conference on
Interactive
Collaborative
Learning
(ICL2019), which
was held in
Bangkok, Thailand,
from 25 to 27
September 2019.
Covering various
fields of interactive

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and collaborative learning, new learning models and applications, research in engineering pedagogy and project-based learning, the contributions focus on innovative ways in which higher education can respond to the real-

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world challenges related to the current transformation in the development of education. Since it was established, in 1998, the ICL conference has been devoted to new approaches in learning with a focus on collaborative

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learning. Today, it is a forum for sharing trends and research findings as well as presenting practical experiences in learning and engineering pedagogy. The book appeals to policymakers, academics, educators,

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researchers in
pedagogy and
learning theory,
school teachers,
and other
professionals in the
learning industry,
and further and
continuing
education.

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