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Gyroscopic Precession

and Gyroscopes *Human*

hearing vs. frequency

response **The World Of**

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miniTalk #2: How does

a MEMS gyroscope

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3D Tracking with IMU

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MEMS and NEMS -

Part 1 Resonant MemS

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actuation method, these resonant MEMS are implemented, e.g., as electrostatic, electrothermal, magnetostatic or piezoelectric devices.

The distinct characteristics of these devices such as a wide frequency range, favorable signal-tonoise ratios, reliability, low power consumption and

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MEMS make them
useful for a variety of
applications ranging
from sensors to timing
devices.

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Resonant MEMS:

Fundamentals,

Implementation, and ...

Description. Part of the

AMN book series, this

book covers the

principles, modeling and

implementation as well

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as applications of resonant MEMS from a unified viewpoint. It starts out with the fundamental equations and phenomena that govern the behavior of resonant MEMS and then gives a detailed overview of their implementation in capacitive, piezoelectric, thermal and organic devices, complemented

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by chapters addressing
the packaging of the
devices and their
stability.

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It starts out with the
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and phenomena that
govern the behavior of
resonant MEMS and
then gives a detailed

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overview of their implementation in capacitive, piezoelectric, thermal and organic devices, complemented by chapters addressing the packaging of the devices and their stability. The last part of the book is devoted to the cutting-edge applications of resonant MEMS such as inertial, chemical and

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biosensors, fluid

properties sensors,
timing devices and
energy ...

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overview of their
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fundamental equations and phenomena that govern the behavior of resonant MEMS and then gives a detailed overview of their implementation in capacitive, piezoelectric, thermal and organic devices, complemented by chapters addressing the packaging of the devices and their stability.

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Fundamentals p.1

--1.Fundamental Theory

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microelectromechanical systems (MEMS) are characterized by sub-millimeter-sized components that are able to oscillate.

Depending on the actuation method, these resonant MEMS are implemented, e.g., as electrostatic, electrothermal, magnetostatic or

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MEMS and organic
devices, complemented
by chapters addressing
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stability.

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12 1 Fundamental

Theory of Resonant

MEMS Devices cycle.U

tilizing Eqs.(1.10)and(1.

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12), the dissipated energy i

obtained as follows: W

$$= \int_{0}^{2\pi} F(t) du = \int_{0}^{2\pi} F(t) u'(t) dt =$$

$$\int_{0}^{2\pi} F_0 \sin \omega t [F_0 k$$

$$D \cos(\omega t - \phi)] dt = \dots =$$

$$\frac{2\pi r F_0^2 [D(r, \phi)]^2 k$$

$$(1.19) \text{ Substituting Eqs. (}$$

1.18) and (1.19) into Eq. (1

.17) yields $Q = \frac{2\pi U \max$

$$W}{\pi r} \Big|_{r=1} = \frac{1}{2\pi r} \Big|_{r=1}$$

$$= 1 =$$

$$= 1 =$$

1 Fundamental Theory of

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characterized by sub-

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The distinct characteristics of these devices such as a wide frequency range, favorable signal-tonoise ratios, reliability, low power consumption and

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MEMS small size make them useful for a variety of applications ranging from sensors to timing devices. The book covers the principles, modeling and implementation as well as applications of resonant MEMS from a unified viewpoint. It starts out with the fundamental equations and phenomena that

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discovery for cancer
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microelectromechanical
(pMEMS) resonators to
a broad audience by
reviewing design
techniques including use
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Modeling, testing and

qualification of

resonators, and

fabrication and large

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techniques to help

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and entrepreneurial

activities in pMEMS.

The authors discuss the

most exciting

developments in the

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and design approaches

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flexural, contour-mode,

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commercialization paths
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resonators in the timing
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are combined. Current
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results with professional
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unique in discussing the
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an easy to understand
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way. Those schemes
include loosely vs
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loop vs closed loop, and

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new world of MEMS is
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knowledge on circuit
and system integration
issues concludes this in-
depth treatise,
illustrating the
advantages of
combining CMOS and
MEMS in the first place,
rather than having a
hybrid solution.

The application of

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Mechanical Systems

(MEMS) in the

biomedical field is

leading to a new

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applications, exploring
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electrical impedance

spectroscopy are

investigated, along with

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engineering and clinical

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'design for reliability'
point of view and
includes examples of
applications in industry.

Mechanics of
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into two main parts. The
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knowledge related to the
microsystems behaviour
and offers an overview
on microsystems and
fundamental design and

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Modelling tools from a
mechanical point of
view, together with
many practical

examples of real
microsystems. The
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mechanical

characterization of
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most important
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(fracture, fatigue,

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stiction, damping phenomena, etc) which are fundamental to fabricate a real working device. Key features:

Provides an overview of MEMS, with special focus on mechanical-based Microsystems and reliability issues.

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