ICT

ICT

Fully Integrated Voltage Quadrupling And Low Phase Noise Oscillator for Ultra Low Voltage Applications

Oscillator Circuit for Ultra-Low Voltage Systems with Reduced Energy Consumption

The invention contains an original integrated circuit topology which can self-start using ultra-low input voltage levels, and step-up the input voltage at least four times to generate differential sinusoidal signals with low phase noise.

Advantages

Self-starting with low input voltage

4x voltage step-up

Low phase-noise

Low cost and profile

High integrated power capacity

Topology that makes the oscillator circuit work with ultra-low input voltage levels

The invention integrates a secondary LC tank oscillator to a standard LC tank using minimum number of circuit components. Thus, it steps up a low (DC) input voltage four times or more to generate differential sinusoidal signals with lower cost, lower input voltage, and lower phase-noise compared to alternative circuit solutions.

The invention provides a topology that enables Voltage Controlled Oscillator or simply Oscillator circuit, which is one of the building blocks of communication and power electronics systems, to work with ultra-low input voltage levels. It offers a low-cost and low phase-noise circuit solution especially to mobile electronic products with low energy requirement.

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Easy and Automatic Detection of Object Borders
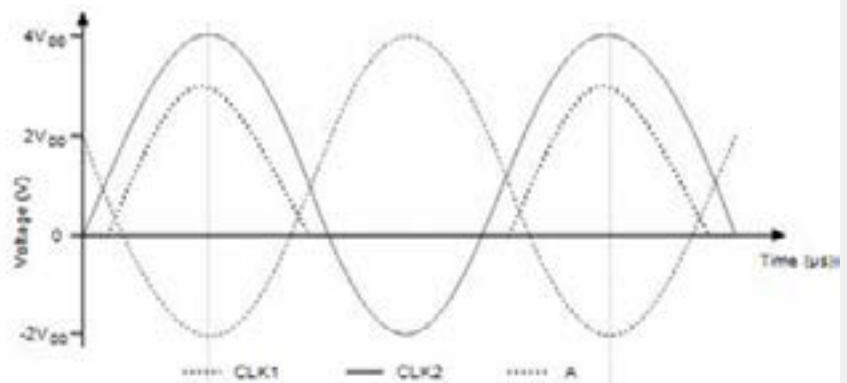
The invention is related to a method that enables object based segmentation of especially air/satellite photographs that are viewed in high resolution.

Advantages

Automatic

Fast

Repetable

Can be used for other applicaitons related to satellite image processing

Not the regions but objects are segmented

The aim of the invention is to be able to determine the borders and outlines of objects automatically with the usage of statistical, spatial and structural features/relationships and with the usage of high resolution air/satellite image data.

Another aim of the invention is to develop a method which enables to define the object as a whole instead of just a pixel and which can operate and work by being minimally affected by restricting elements such as ambient light, air conditions and resolution.
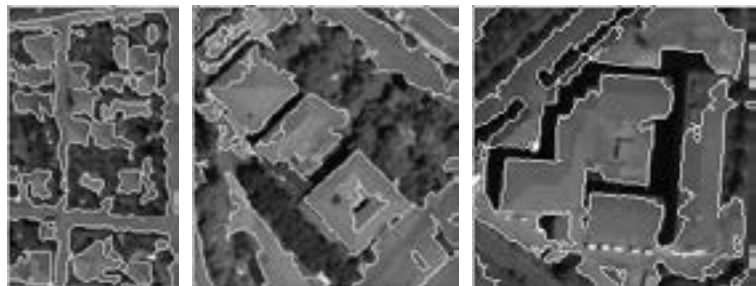
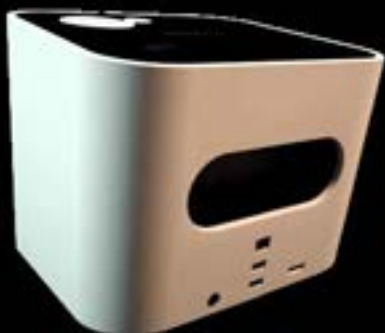# Cloud Content Sharing and Interaction Box

An innovative solution providing portable, scalable, definable and secure learning cloud

A breakthrough invention enabling various organizations in the field of education, health, architecture, engineering, marketing and conference business to share their content instantaneously at minimum cost.

Advantages

Secure file sharing

Simultaneous training and presentation

Personalised content and file sharing

Interoperability

Unified solution

Enabling offline creation of customisable content and platform-independent sharing

Basic problems of in-class educational technologie are; dependency on a platform difficulties in knowledge sharing (multimedia diversity), efficiency and expertise problems in e-content in contrast to high demand, sustainability and quality problems based on lack of academic personnel with sufficient technical skills and difficulty in adaptation of the students, manageability difficulties of created content and learning environment, and inability of content creation due to technologic constraints.

Content sharing platform has the following features are in the scope of standards and specific scenarios, it can communicate with the peripheral devices connected to the network that it hosts via multiple protocols including USB, Bluetooth, Zigbee, DICOM, HL7 or IEEE 802.3 and 802.11.

An Energy Efficient Scheduling Method and Algorithm for Nondeterministic Traffic in IEEE 802.15.4e Time Slotted Channel Hopping (TSCH) Medium Access Control
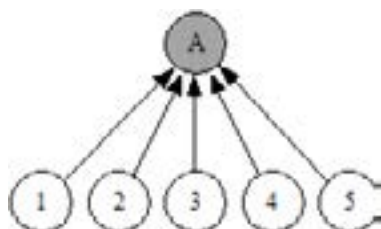
Long Battery Life Network Device for Industrial IoT Systems

This invention introduces a scheduling method for low rate, heterogeneous and low latency traffic networks while minimizing the energy consumption and thus extending the battery life of the device.

A network device which can be adjusted by the user

The proposed device in the invention works in accordance with the IEEE 802.15.4e TSCH operation mode. Scheduling method used by the device is based on a heuristic model and device is capable of estimating performance through this model. Moreover, the model is updated according to the current measurements.

Algorithm adopted by the device realizes the network configuration that complies with the latency and reliability constraints while providing minimum energy consumption using the estimation model.

Advantages

Adaptability
Adaptability to the industrial IoT standards and capability of parallel working with other solutions

Low complexity
Since the estimations are based on a heuristic approach, the computational power is very low

Energy efficiency
The device finds the most energy efficient solution possible and thus maximizes its battery life

Self-adaptability
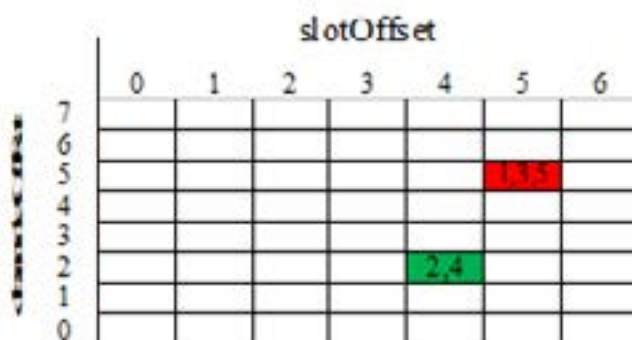Model is updated according to the environmental factors

Scalability
Since the algorithm works in a distributed manner, performance is high even in networks with large number of devices
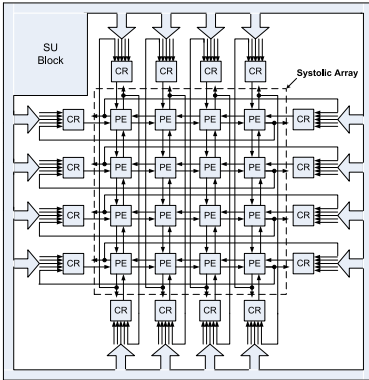
Systolic Array Architecture for Fast IP Lookup

High Throughput IP Lookup Engine

Lookup engine provides much higher throughput than existing architectures with increased parallelism and is suitable for any type of tree structure for both IPv4/v6 schemes.

Advantages

High speed
Tbps throughput rate is achieved

Low delay
The average search delay is about 7ns per packet

IPv6 support
Any prefix tree in IPv6 can be mapped on the architecture

Modular extendibility
The number of PEs can be increased for more performance

Fast updates
Supports incremental routing table updates

Achieves fast IP packet processing in core routers

SRAM-based systolic architecture employs multiple pipelines that improve search throughput.

Each PE including an SRAM, FIFO queue and match logic is organized in a two dimensional circular structure that remove length limit in pipelines and provide memory balance on SRAMs. Hence the design supports any kind of prefix tree both in IPv4 and v6.
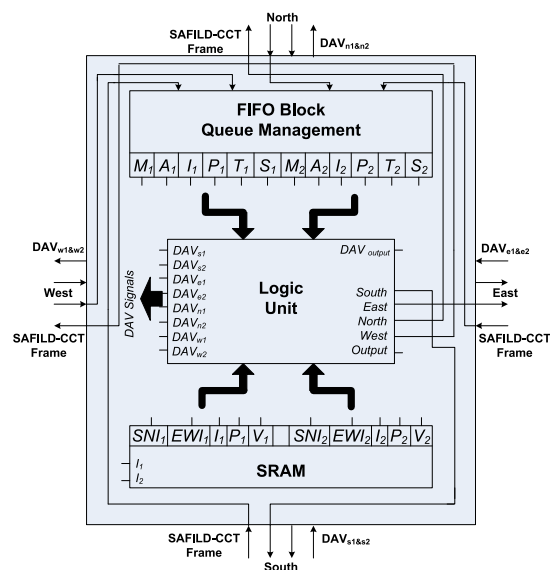
Methods and Apparatuses for the Joint Detection of the Number of Sources and Their Direction of Arrivals

A Common Method for the Sources in Different Forms

The present invention is related to the field of communications, wireless sensors and sensor arrays. One of the important application and use of the innovation is to detect the number of sources in the environment with the help of an apparatus which consists of a number of sensors.

Advantages

Error functions are found without requiring a search

High communication capacity

High efficiency

Acceptable performance loss

The apparatuses and method for finding the number of signals of the sources and their direction of arrivals

There are a variety of methods and algorithms for the detection of the number of sources by using a sensor array. In this invention, the presented methods perform significantly better even when the above assumptions do not hold. This innovation finds the number of sources in a simple and relatively efficient manner. Furthermore, DOA's for the corresponding sources are found at the same time. There is no search process. The accuracy of the innovation is better than the alternative techniques.

One of the most important parts of source estimation is the selection of an error criterion. In this invention, two different criteria are used namely, deterministic maximum likelihood error criterion (DTML) and stochastic maximum likelihood criterion (STML). These two criteria are used by employing root-MUSIC algorithm first. Therefore error functions are computed without a search process.
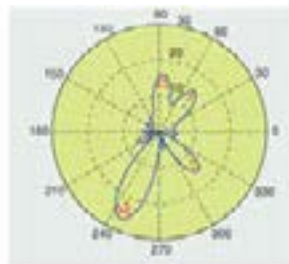
Integrating Different Profiles to Form a Process
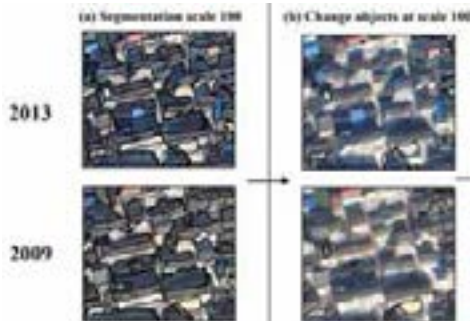
High Efficiency for Integration and Interoperability

It is a method to integrate different profiles to form a process.

Advantages

Autmatic and fast result

Multi-party collaboration

High accuracy

Graphical interface use

IHE actors are easily grouped

To develop interoperability solutions, industry uses interoperability profiles. An important initiative, Integrating Healthcare Enterprise (IHE), has adopted this profile approach to provide e-health interoperability. However, profiles are defined for specific use cases, and it is necessary to combine multiple profiles to provide the desired functionality. It is very difficult to do this manually because IHE has defined too many profiles.

With the method developed by the invention, the automatic extraction of the integrated workflow definition has been achieved when the IHE actors are grouped. For this purpose, the IHE profiles are defined by the OASIS ebXML Business Process Specification standard, a standard that can be processed by computers.

At the same time, this process was supported by a graphical interface. IHE profiles are tested by companies after they are applied for certification. The invention also allows for the automatic configuration of these tests.

An Education Method

A Language Teaching Method with a Mobile Phone

The invention is based on the idea of using multimedia messages (MMS) and short messages (SMS) over mobile phones in teaching English or another language.

Advantages

Learning with mobile phone independent location and time

On-line evaluation

A motivator from the outside for motivation to start studying

Being a multimedia based system

Internet connection is not required because it is based on MMS and SMS

An education system for language teaching via mobile

In the method developed by the invention, students are encouraged to work by sending them multimedia or short messages and exercises and application materials. This allows students to practice without opening a lecture note or book, without connecting to a website or using a teaching software. The invention combines lecturing with MMS that will be delivered via mobile phone and exams with SMS which will again be delivered via mobile phone.

The most basic innovation is that the prepared teaching materials can be composed of four separate components as video, graphics, plain text and audio and can be sent as MMS to users at the desired time of day via mobile phones. Another innovation is the interactive SMS test system.

Game Based Eye Training System for People with Low Vision

Eye Training with Games

The system is an eyesight training system based on computer technology and works with an eye tracking device.

Advantages

The training system based on computer technology for enhancing the eyesight

Objective evaluation

The tracing of the eyesight during the process

The training can be maintained at home and the enhancements can be tracked remotely

It is a game based and a motivating system

A training system for enhancing the eyesight of people with low vision

There is a need for training systems to enhance eyesight of people with low vision. It is hard to obtain objective and effective results from the systems used before our invention because they were based on instructor and classical materials. However, the invention is aimed to obtain objective and effective results because it is a game based computer technology.

The technology is basically a system which works with a computer and an eye tracking device on it. The gaze points of the users on the screen are identified by the developed system. When the user sees and focuses on the object on the screen, system moves to the next step. The training session is realized as a computer game. User does his/ her eye training with a special designed computer game.

Electronic and Motorized Wheelchair System That can be Controlled with Eye Movements

Walking with eyes

It is related to a computer-based system, in which commands using only eye movements, can be sent to the electronic and motorized wheelchair.

Advantages

Moving wheelchair by eye movements

Providing movement ability for paralyzed people

Moving wheelchair forward, backward, right and left via eye movements

Giving commands to wheelchair via computer-based system

Based on eye movements

Providing eye movement based system for paralyzed people

The invention can provide movement for an electronic wheelchair that is connected to a computer based system using only eye movements without the need to use any kind of devices such as a control lever, computer with wireless connection, tablet computer, and mobile phones that are usually necessary to use the motorized wheelchair.

A Phase Coherent Digital Step Attenuator

A Digital Step Attenuator for 5G and Beyond

By reducing the unwanted phase shift, the invention makes it easier to design phased array systems for next generation communication (5G and beyond) and radar systems.

Advantages

Cheap
Solution to the phase shift problem without increasing the semi-conductor area

Reliable
Solution the phase shift problem without the need for problematic flip-chip packaging

High performance
4-folds reduction in phase shift while achiving similar accuracy and linearity specifications with the state-of-the-art

Lower system cost
With the reduction of the phase-shift, lower phase-array system cost, by decreasing the phase calibration cycles
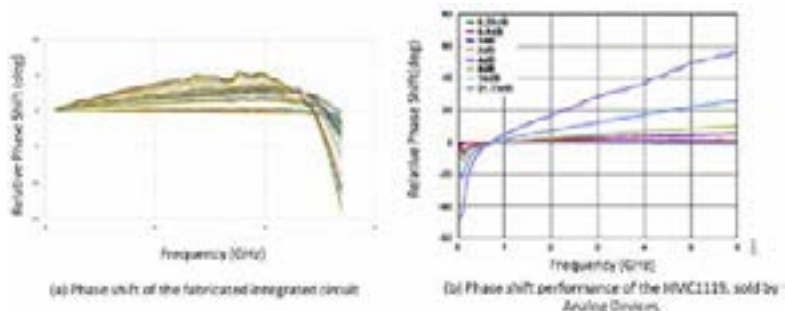
Adjustable to the specifications
Adjustable circuit topology to design digital step attenuators for different frequency and phase shift specifications

Reduces the unwanted phase shift with respect the state and frequency changes

With switchable filter elements, the unwanted phase shift inherent to the standard digital step attenuators (caused by the low-pass, high pass architecture) is reduced. While achiving low phase shift, other important systems specifications, such as accuracy and linearity, were not sacrificed.

With this invention, a 4-folds reduction of phase shift was achieved, while keeping accuracy and linearity specifications on par with the state-of-the-art digital step attenuators.

(a) Phase shift of the fabricated integrated circuit

(b) Phase shift performance of the HMC1119, sold by Analog Devices.

Performance comparison of the fabricated digital step attenuator with that of one of the state-of-the-art products

Remote Voting and Vote Verification System

Remote Safe Voting System

A voting system has been developed that allows individuals to vote on their own computer via Internet and later check whether this it is counted correctly or not.

It is possible to vote safely without going to the polls

The invention provides an improved authentication system using smart ID cards. For verification, existing symmetric and asymmetric encryption and signing algorithms are used.

With the invention, it is possible to vote as secure as a normal election, without having to go to the polls. Particularly, it facilitates the voting of the citizens living abroad, thus contributing to the higher participation rate in the elections. It also significantly reduces the cost of the elections, as there is no need to set up and carry the poles.

Advantages

Allows individuals to vote without going to the polls

The ballot papers are digitally transmitted safely

Significantly reduces selection costs

It is a safe system since it allows verification

Since the system supports all kinds of selection system, it does not require additional cost after installation

Fiber Optic MEMS Microphone

Immune to Electromagnetic Interference, High Sensitivity, MEMS and Fiber Optic Based Microphone

This invention presents a superior microphone compared to other fiber optic MEMS microphone due to its optically adjustable deflectable membrane design, which is the most sensitive element of the microphone.
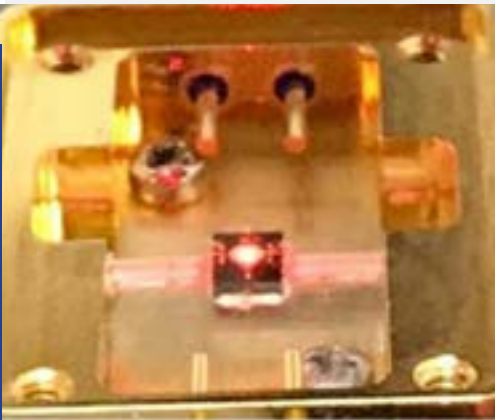
Advantages

Reliable

Long lifetime

High sensitivity

EM immunity

Durability against harsh conditions

Reliable, high sensitivity, durability against harsh environments type microphone solution

Fiber-optic MEMS microphones are obtained by combining MEMS passive diaphragm and fiber optics. In this invention, an electrically adjustable MEMS membrane instead of a MEMS passive diaphragm is presented. Also, electrical power is generated from the incident laser light right on the spot of the MEMS membrane through a photodiode chip. In doing so, impractical electrical conduction along the fiber-optic cable is eliminted and the cost for large capacity use has been significantly reduced. At this point, the idea of transforming the energy of the light carried within the optical cable to the electrical voltage on the membrane by means of a photodetector is used.
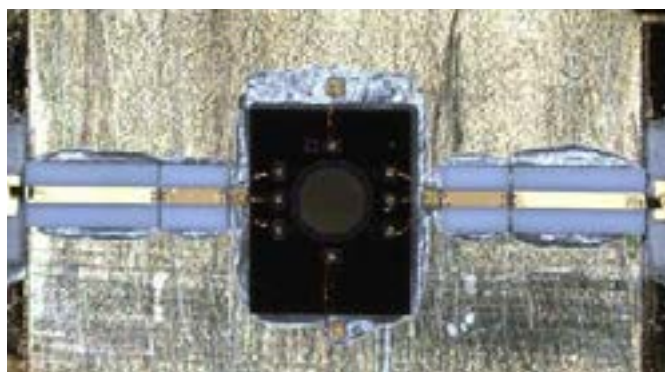
MEMS Microphone chip view

Joint Direction-of-Arrival Estimation and Source Separation Method for Acoustic Sources

Next generation audio recording for next generation multimedia content

This invention is the first method that can jointly localise and separate sound sources from recordings of complex sound scenes with high computational efficiency and audio quality.

Advantages

High audio quality
It allows higher sound quality than other methods that rely on beamforming

Accuracy
It allows estimating the directions of sound sources with very high accuracy

Low computational cost
It has a computational cost that would allow operation in real-time

Compatibility with next-generation audio (NGA) systems
It can be used to extract audio objects and the features of the sound scene

Backwards compatibility
It can be used both with real recordings made with spherical microphone arrays and with synthetically generated higher-order Ambisonics (HOA) signals

It allows estimating the directions of sound sources with very high accuracy

Next generation broadcast systems rely on object-based audio which has recently been standardised by ISO/IEC as the MPEG-H 3D Audio standard. One of the most critical problems of object-based audio (OBA) workflow is the extraction of audio objects from real recordings of sound scenes. The invention provides an efficient solution to this problem

This technology is an innovative signal processing method that allows jointly estimating the directions of sound sources and separating them from recordings made using rigid spherical microphone arrays. After applying a windowed Fourier transform and the spherical harmonic decomposition, a sparse, dictionary-based representation of the sound field is used to obtain a time-frequency-direction-amplitude parameterisation which is followed by virtual beamforming to achieve high performance in jointly estimating the directions of sound sources and separating them even under high levels of reverberation.

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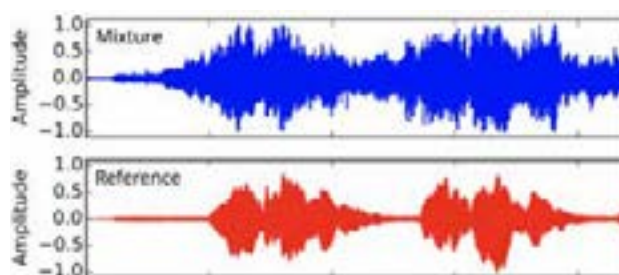
A Novel Experimental Modal Analysis Method for Nonlinear Engineering Structures Based on Response Control Approach

Response Controlled-Stepped-Sine Testing (RCT)

The invention provides experimental modal analysis of nonlinear systems, which yields modal models for nonlinear systems. It also provides direct experimental extraction of frequency response curves, including any unstable branch by using standard/commercial modal testing equipment innovatively.
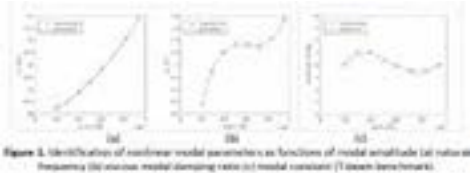

Figure 1. Identification of nonlinear modal parameters as functions of modal amplitude (a) ratio or frequency (b) viscous modal damping ratio (c) modal constant (T-beam benchmark).

Advantages

Pioneering
Identification of nonlinear modal parameters and direct experimental extraction of unstable frequency responses, which is not an available option in standard/commercial modal testing hardware/software

Simple and Innovative
No need for sophisticated control architecture: Standard/commercial modal testing hardware is used innovatively

Low Investment Cost
The invention can be implemented as a simple "software patch" which can be integrated to commercial modal analysis software

User friendly
Innovative use of linear modal analysis tools to identify (strongly) nonlinear systems. The method can be easily adopted by practicing engineers, which makes it very attractive for industrial applications

High Technology Readiness
Fully integrated with standard/commercial modal testing equipment. Actual methodology has been thoroughly demonstrated and tested on a benchmark test setup and real engineering structures: T-beam benchmark with strong stiffness nonlinearity, real missile structure with bolted-joint nonlinearity and control fin actuation mechanism of a real missile which exhibits strong nonlinearity due to backlash and friction

Experimental Modal Analysis of Nonlinear Systems

- Closed-loop control of the response amplitude during stepped-sine testing (RCT strategy) with standard commercial modal testing equipment.
- Quasi-linearization of frequency response curves by keeping the response (displacement) amplitude of the driving point constant during stepped-sine testing.
- Experimental extraction of nonlinear modal parameters by applying standard linear modal analysis tools to quasi-linear frequency response curves.
- Synthesis of frequency response curves for untested harmonic forcing scenarios by using identified nonlinear modal parameters, and by employing Newton's Method with arc-length continuation algorithm.
- Construction of the so-called Harmonic Force Surface (HFS) from harmonic force spectra measured (at constant displacement amplitude levels) with standard commercial modal testing equipment.
- Extraction of unstable frequency responses of nonlinear systems from HFS.
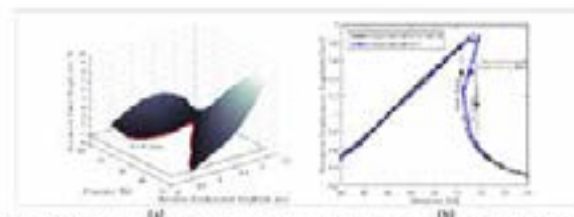

Figure 2. (a) Determination of the harmonic response spectrum with any existing unstable branch by cutting HFS with a constant force plane (b) Comparison of the response spectrum obtained by HFS with the one obtained by force controlled testing (T-beam benchmark).