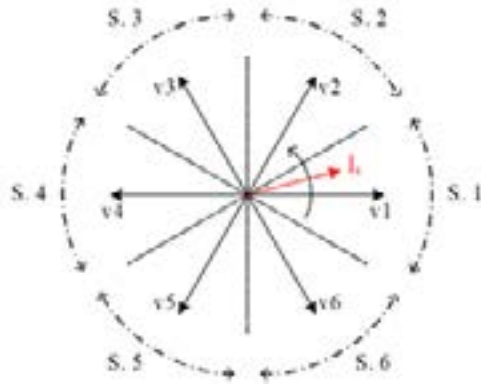


Machinery and Manufacturing

MACHINERY AND MANUFACTURING

Algorithm That Reduces The Prediction Vectors for Model Predictive Control of Alternating Current Motors	3
Installation and Water Disposal Free Air Conditioner Located Around the Lower Door Region	4
Fused Filament Fabrication Method on a Powder Bed	5
Rotary Drum for Microwave Ovens	6
Three Dimensional Mixer for Microwave Ovens	7
Suitable for Uninterruptible Power Supplies and Motor Drives	8
Internal Heating System for Forging Dies	9
Bilateral Operating Suspension	10
Method of Wafer Level Hermetic Packaging with Vertical Feedthroughs	11
Hermetic Packaging Method for SOI-MEMS Devices with Vertical Feedthroughs	12
Multi-Directional Torsional Hysteretic Damper	13
MARTI	14
Access System for Disabled / STAIRCASE	15
Access System for Disabled / RAMP	16
Access System for Disabled / VEHICLES	17
Welding Process Control System with Fiber Bragg Grating-Based Optical Sensors	18
A Surface Roughness Measurement Method and Setup	19
A Three Axis Capacitive MEMS Accelerometer on a Single Substrate	20
Quantized Detection in Uplink MIMO with Oversampling	21
Low-stress Stereolithography	22

Algorithm That Reduces The Prediction Vectors for Model Predictive Control of Alternating Current Motors



An algorithm to reduce the computational burden of MPC

It reduces the computational burden of the MPC of alternating current machines by decreasing the set of prediction vectors. Besides, it offers switching loss reduction to the inverter that the technique has been applied on.

Advantages

Reduction in computational burden

Enabling long horizon control applications due to the reduction in computation burden

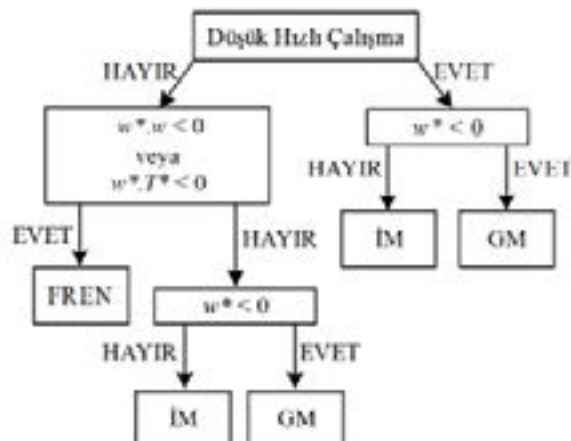
Efficiency increase due to switching loss reduction

Enabling the size reduction of the heat-sink due to the increase in efficiency

To obtain a reduction in computational burden and switching losses

In the classical sense of MPC of alternating motor drives, all of the vectors that the inverter can produce are evaluated and the optimum vector is applied. Our new algorithm discards some of the vectors without the need of evaluating them, foreseeing that those vectors would turn out to be non-optimal. Thus, reduction in the computational burden is achieved without sacrificing the dynamic performance of the motor drive.

Besides, with the observations done on stator current and a careful selection of the zero vectors, reduction in the switching losses of the motor driving inverter is achieved with the degree of reduction depending on the motor drive scenario. Thus, efficiency is increased for the motor drive inverter.



Installation and Water Disposal Free Air Conditioner Located Around the Lower Door Region



Installation-Free Portable Door Air Conditioner

The invention has the advantage of no installation need; it is only slipped under any door and grab the door from both sides with its U shape. The compressor unit, which is the noisy part, remains at the outer side of the room and the air blowing part is kept inside the room, providing a silent environment with the desired temperature.

Advantages

Due to its wheeled design and in-existent need of installment, it can be moved easily to any desired area

It is enough to place it by slipping under any door without any need of installation

Because of its non-existing need of water disposal unlike its mobile rivals, this design is user friendly

Its attached design to the door looks better

It provides efficient use of area with its placement in the dead space around the door

Mobile, silent, user friendly, installation-free

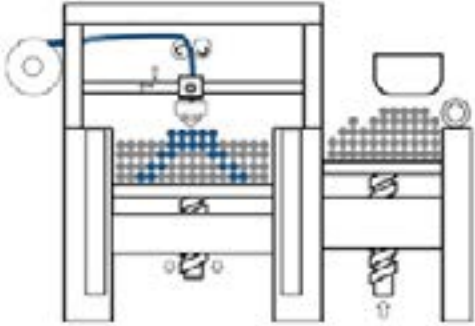
The design works with the same heating / cooling principle of conventional ACs but differs in the path which condensed water follows. In the other designs, condensed water disposed from the system where it is evaporated on the compressor in this AC.

Compressor part of the conventional ACs are located outside the building, therefore preventing voices coming in. However, this design separates these two parts with a U shape positioning and locates the door between those two parts.

The air outflow region is in the room where the noisy compressor part remains outer of the room, providing a silent air conditioning. As there is no damage or modification on the door, the AC unit can be removed by scrolling whenever it is desired.



Fused Filament Fabrication Method on a Powder Bed



Easy Additive Manufacturing of Intricate Support-Free Structures

The working principle of the invention is based on the fused filament fabrication process amendment by making it on a powder bed

Advantages

Ease of production

Process advantage for intricate structures

Cost

Low production cost due to the elimination of supports

Durability

Production of more durable products due to homogeneous cooling environment

Sustainability

Advantage of use of recyclable materials

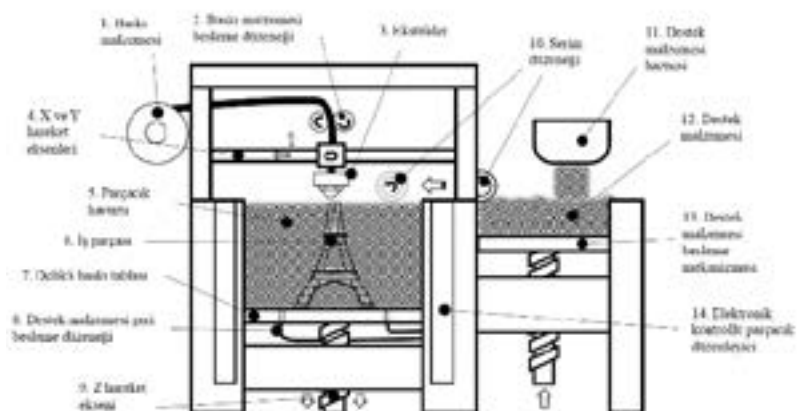
Environmentally friendly

Use of materials harmless to humans and the nature

Fused filament fabrication based additive manufacturing

The proposed fabrication method eliminates the need for the support structure for intricate shapes owing to its inherent process characteristics. The production quality and costs are reduced for difficult parts such as lattice structures. The invention contributes to the global sustainability with the use of harmless recyclable materials.

The invention offers a simple solution for the problematic and costly support structures in fused filament fabrication based additive manufacturing. It provides the easy production of durable objects with reduced cost.



Three Dimensional Mixer for Microwave Ovens



Equal Distribution of Heat on Food

In microwave ovens, where food is heated and cooked using microwave energy, three dimensional mixer has been developed that allows the food to be heated and cooked in equal amounts on each side using the principle of mixing food inside.

Advantages

Equal amount of heat distribution

High efficiency

Energy-saving

More efficient heating is possible in a shorter time

The three-dimensional mixer developed in the present invention is housed in a specially designed mid-sized glass container, and thanks to the wall strippers, the wings and the bottom strippers, the food contained in the container during the operation of the microwave oven is mixed in three dimensions: diameter, height and circularity. Thus, the heat reaches equal amounts on every side of the food and the heat transfer between the molecules can be sufficient for a homogenous heating.

By ensuring that the food is exposed to equal amounts of microwave energy on all sides, the deterioration that can occur in certain parts of the food is prevented.



Rotary Drum for Microwave Ovens



Equal Distribution of Heat on Food

In microwave ovens, where food is heated and cooked using microwave energy, rotary drum technology has been developed that allows the food to be heated and cooked in equal amounts on each side using the principle of mixing food inside.

Advantages

- Equal amount of heat distribution
- High efficiency
- Energy-saving
- Applicability to each microwave oven

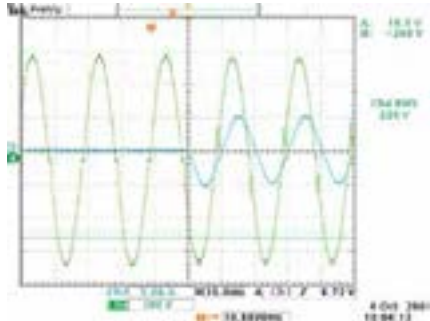
More efficient heating is possible in a shorter time

Thanks to the technology developed by the invention, the rotary drum for microwave ovens can be rotated around both the main shaft and its own axis to move the food in each of the three dimensions. Thus, besides turning the food in the angular dimension, it also mixes itself with the rotation of the drum around its axis. With the help of this process in three dimensions, every side of the food can be exposed to the same amount of microwave energy. Because the food is exposed to equal amounts of microwave energy on all sides, the intensity of the microwave energy to be dispensed onto the food can be low and in this case the time required for food molecules heated by microwave energy to be distributed among themselves is achieved.

It is also possible to utilize the maximum volume of the internal volume of the microwave ovens by using more than one drum, so that the optimum amount of food can be processed at the same time.



Suitable for Uninterruptible Power Supplies and Motor Drives



Single-Phase Or Three-Phase Sinus Output Inverter

The new technology requires less space and has superior properties with low harmonic distortion sinus output voltage.

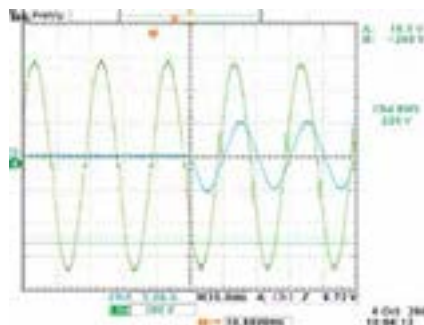
Advantages

- Sinusoidal voltage output
- Single-phase or three-phase output
- Does not require output filter
- Less than 3% total harmonic distortion
- Rated output voltage even at low input voltage
- High efficiency electronic circuit
- Smaller volume than comparable topologies

Rated output even at low mains voltage

In present technology, uninterruptible power supplies and motor drives have an output filter which filters the PWM modulated output voltage of the inverter to obtain a sinusoidal output. As a consequence additional space is needed and the circuit efficiency is lowered. Over modulation techniques are used to obtain rated output at low input voltages. In such circumstances, output voltage distortion increases, the voltage drop on the filter further increases the lowest voltage at which rated output voltage can be obtained.

In the new technique,; there is no need for an additional filter to obtain sinus output. In this technology even if the input voltage drops below 20% of its rated value, sinusoidal output voltage at desired voltage level can be obtained.



Internal Heating System for Forging Dies

Short Preheating Process

The invention relates to a die heating system that is developed for preheating and continuous heating of forging dies internally.

Long die life, and mass production performance

The present invention discloses an internal heating system for forging dies by using electrical cartridge heaters placed inside the channels drilled at feasible locations relative to the die cavity. The system is automated to preheat the forging die and control the temperature of the die during the forging process.

The system is used for hot, warm or cold forging of steel, aluminum, copper, titanium alloys or any other metal forged in forging industry.

Advantages

Eliminates, reduces thermal fatigue , operational time losses, combustion gasses

Obtains operational ease and convenience

Applies heating energy directly to the forging dies

Eliminates decarburization, surface wear, on forging die surfaces

Increases the uniformity of the temperature distribution on dies



Bilateral Operating Suspension



Symmetric Suspension Performance in Bidirectional Loading

The invention offers to dampen bidirectional forces and vibration by using a simpler mechanism, using a single piston/spring pair with the same performance.

Advantages

Bilateral

New suspension can dampen bilateral forces and vibration

Compact

Invention provides solution in a smaller volume than conventional design

Simple

Invention has a simpler design relative to a classic solution

Scalable

Application areas can vary from robots to big electric vehicles

Cost effective

New suspension brings in a cheaper solution to the requirements

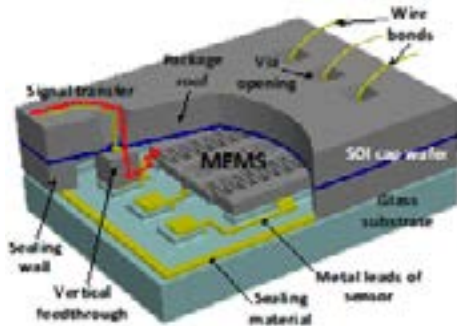
A compact suspension system that can dampen bidirectional forces and vibration with the same performance

Some vehicles and robots need suspension which can provide symmetric performance regardless of vehicle's orientation (upside down or not). Also, when encountered with a deep hole, conventional suspensions stay in their elongated state and cease to perform their functions. New suspension design is useful in solving these kinds of problems. Especially, for vehicles that use electric hub motors, this invention provides a compact solution with symmetric damping performance.

Main principle of invention is to compress a piston/spring couple in either direction of motion along the suspension stroke axis. In order to achieve this, both ends of spring/piston couple are freed to move along the stroke axis on slider mechanism and couple is limited by suspension connection end plates.



Method of Wafer Level Hermetic Packaging with Vertical Feedthroughs



Hermetically Packaged Microstructures

Hermetic packaging of microstructures fabricated by using the MEMS technology under a controlled atmosphere and transfer of microstructure leads to outside of the package without degrading the hermeticity.

Advantages

Wafer-level-packaging

Packaging of all microstructures at the same step

Hermetic

Packaging of microstructures under desired environmental conditions

Vertical-feedthroughs

Leads of the microstructures are vertically transferred to the outside of the package

Low cost

Reduced process steps compared to the other techniques in the literature

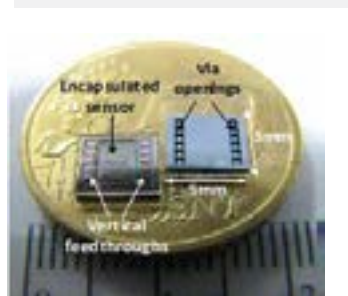
Compatibility

Packaging with or without any sealing material at low or moderate temperatures

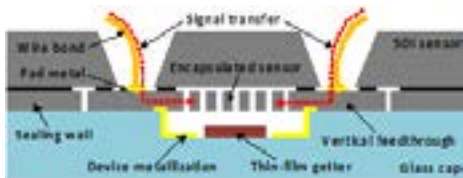
Hermetic packaging of all microstructures on the same wafer

Wafer level packaging of microstructures increases the fabrication yield, decreases the package size as well as the cost and as a result they become useful in a wide range of applications.

In this invention, a sensor wafer is bonded to the cap wafer by using silicon-metal based alloys or silicon-glass anodic bonding techniques for the hermetic packaging of microstructures. The formation of vertical feedthroughs are formed on the cap wafer without any need for complex drilling/filling process steps different than the other techniques in the literature. This method is applicable to the other type of sensor wafers fabricated with various process flows.



Hermetic Packaging Method for SOI-MEMS Devices with Vertical Feedthroughs



Hermetically Packaged SOI-MEMS Devices

Hermetic packaging of MEMS devices with vertical feedthroughs on an SOI wafer at the same step.

Advantages

Wafer-level-packaging

Packaging of all microstructures on an SOI wafer at the same step

Hermetic

Packaging of microstructures under desired environmental conditions

Vertical-feedthroughs

Leads of the microstructures formed on the same SOI wafer with microstructures are vertically transferred to the outside of the package

Low cost

Reduced material usage and process steps compared to the other techniques in the literature

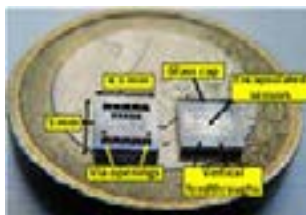
Compatibility

Packaging with or without any sealing material at low or moderate temperatures

Hermetic packaging of microstructures which are formed on the same SOI wafer with the vertical feedthroughs

Wafer level packaging of microstructures increases the fabrication yield, decreases the package size as well as the cost and as a result they become useful in a wide range of applications. In this invention, an SOI wafer containing both microstructures and vertical feedthroughs is bonded to a cap wafer by using silicon-metal based alloys or silicon-glass anodic bonding techniques for the hermetic packaging of microstructures.

The formation of vertical feedthroughs on the same SOI wafer with the microstructures without requiring any complex drilling/filling process allows this hermetic packaging method to be done with reduced material usage and process steps compared to the other methods in the literature.



Multi-Directional Torsional Hysteretic Damper



Anti-Seismic Devices Against Earthquakes

The invention relates to seismic resistant devices and in particular, to seismic hysteretic dampers, used to protect the structures against severe earthquake shakings.

Advantages

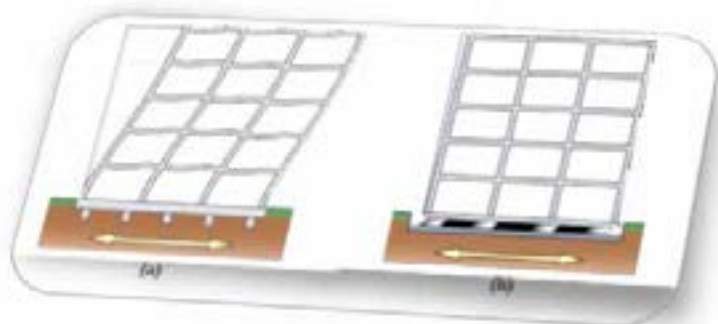
- Safe
- Economical
- Longer lifetime
- Simple set up
- Durable

Safety during an earthquake

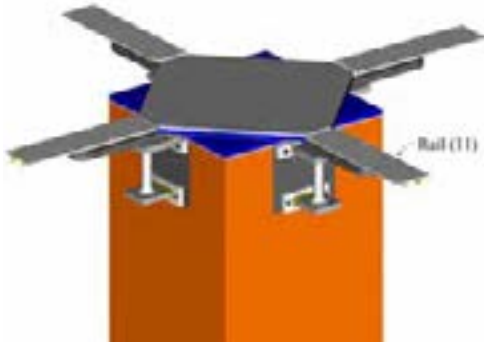
The invention develops a multidirectional hysteretic damper better, or as effective in behavior as the available hysteretic dampers and more economical to manufacture.

Although the use of cylindrical steel cores as hysteretic damping elements is a known technique, the design through which they are assembled into a multi-directional hysteretic damper is the new and unique feature of the invention.

The seismic resistant devices used in the invention are installed at points where large displacements is expected due to earthquake shakings.



MARTI



Multi-Directional Adaptive Torsional Isolator

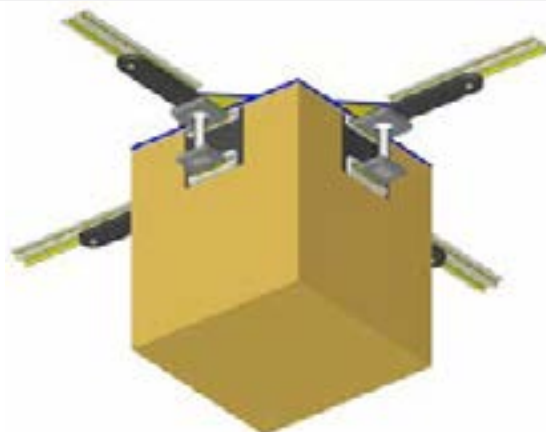
The invention is related to a multidirectional adaptive re-centering torsion isolator that is used for isolating buildings, tanks and bridges from earthquakes.

Advantages

- Safe
- Economical
- Longer lifetime
- Simple set up
- Durable

The performance is independent of environmental factors

The invention is related to a multidirectional adaptive re-centering torsion isolator that is used for isolating buildings, tanks and bridges from earthquakes. The multidirectional adaptive re-centering torsion isolator comprises a flat articulated slider and four or more cylindrical energy dissipaters. The flat articulated slider positioned on top of the column provides vertical load transmission, low friction and horizontal displacement capacity. The cylindrical energy dissipaters provide displacement, re-centering and damping in any of the horizontal directions.



Access System for Disabled / STAIRCASE



Mobility for Disabled People on the Stairs

The invention is about an access system for disabled persons who are blind or using wheel chairs or crutches, in order to help them to navigate between elevation differences.

Advantages

Ease of use and simple set up

Economical

Safe

Suitable for mass production

Applicable to all kinds of structures

A mobile system that can easily be installed

The invention relates to an access system for disabled that is installed upon a staircase when an appropriate place can not be found for a ramp to enable the disabled people to move between levels of ground with height differences , without eliminating the function of staircase.

The access system for disabled developed with this invention can be applied in two ways: with a sloped platform and with stairsteps. This system for disabled installed on the staircase turns into one that can conveniently be used partially or completely by both the disabled and able.



Access System for Disabled / RAMP

Easy to Move Between Lower and Upper Levels of Ground with Height Differences

The invention is about an access system for disabled persons who are blind or using wheel chairs or crutches, in order to help them to navigate between elevation differences.

Applicable solutions for disabled people

The invention is about an access system for disabled persons who are blind or using wheelchairs or crutches, in order to help them to navigate between elevation differences. System has a moving platform to get up the higher level or down the lower level.

The system developed provides a solution which can be used only as a ramp when needed, can reduce the slope of the platform for the comfort and the safety of the disabled person and can be run with hydrolic or mechanic systems and with electricity.

Advantages

Ease of use and simple set up

Economical

Safe

Suitable for mass production

Applicable to all kinds of structures



Access System for Disabled / VEHICLES



Ease of Access to Vehicles

The invention relates to an access system that enables the disabled using a wheelchair to access elevations with boarding levels higher than ground level, which they can not reach without external help.

Advantages

- Ease of use and simple set up
- Economical
- Safe
- Suitable for mass production

Wheelchair users can easily board the vehicle

The invention developed a system which enables the elevation of the platform upon which the wheelchair and its user are placed so that the wheelchair user can reach the internal cabin of the motor vehicle.

It is a lift system which can be used with any linear actuator with the application of vertical force to the lifting systems and which can be installed onto big or small motor vehicles. It does not require frequent maintenance owing to its simple structure, which is durable under unexpected loads, and which has a low initial installation cost.



Welding Process Control System with Fiber Bragg Grating-Based Optical Sensors



The Continuity of Quality Control in Manual Sources is Possible

The invention relates to the estimation and / or control of the source quality of the time-dependent position (position) information received using a fiber bragg grid-based optical sensor system coupled to the welding torch.

Advantages

High sensitivity

Lower cost

Real-time control

Continuous monitoring of position and speed is possible

Welding at the right position and at the right speed with instant feedback

With the proposed system, a more accurate correlation is established for the welding quality estimation, taking into consideration the welding operation parameters as well as the location of the torch relative to the work piece.

In addition to the source parameter set-up, fibers with fiber bragg grating are placed directly on the cable of the welding torch. Thus, it is possible to determine in real time the position of the welding torch in relation to the workpiece to be welded.

The position information of the welding torch and the parameter records taken during the welding operation are compared with a database containing the parameters and torch position information to be prepared by welding tests. According to the results obtained, it is foreseen to increase the quality of the resource by controlling the quality of the resource or directing the operator.



A Surface Roughness Measurement Method and Setup

A Solution for Industry Applications Which Needs High Precision and Accuracy

This invention is related to a method and setup for measuring surface roughness and waviness.

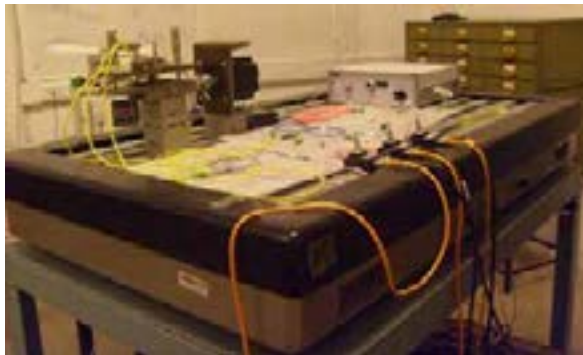
Advantages

- Accurate measurement
- Adaptable for micro machines
- Less cost
- Adjustable distance
- Easy to apply

It can be used in machines of different sizes ranging from micro machines to large machines

Measurement of surface roughness and waviness of surfaces is an important issue especially in different industry applications which needs high precision and accuracy. Therefore, numerous methods and setups have been developed for measuring surface roughness.

This invention is related to a method and setup for measuring surface roughness and waviness. In this technology, a surface to be analyzed and an interferometer interacting with said surface, being displaced relative to each other are used. Using the interference fringes obtained during the displacement along a particular direction (this particular direction is named as direction in this document after this point), the surface profile of the surface along the projection of the direction of progress is determined.



A Three Axis Capacitive MEMS Accelerometer on a Single Substrate



Fabrication of a self packaged three axis a capacitive MEMS accelerometer

A three axis accelerometer design and fabrication approach are introduced, where the working principle and performance of each axis accelerometers are same. As a result, a tactical grade level three axis accelerometer could be fabricated with this invention.

Advantages

A high performance vertical axis accelerometer design is introduced where its working principle is based on the high performance lateral ones

Fabrication of this vertical axis accelerometer is implemented to the lateral ones without requirement of additional fabrication steps

As a result of this implementation, a high performance three axis accelerometer with same performance parameters on each axis could be fabricated

Those accelerometers are fabricated with a packaging layer without an additional fabrication step

Dimension of the three axis accelerometer is minimized with a higher and equal performance results at each measurement axis

A vertical axis capacitive MEMS accelerometer design where its working principle is same as the ones used for lateral axis accelerometers

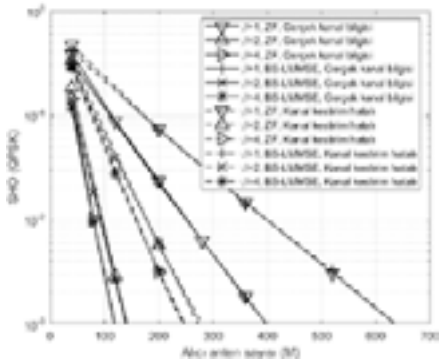
The main problem of the current three axis accelerometers where both military and commercial usage of them exists, is not having same performance parameters in each axis, especially compared to the lateral and vertical ones. The main reason is that, working principle of existing vertical axis accelerometers are not based on differential sensing principle which is the case for high performance lateral axis accelerometer.

Current fabrication approach of vertical axis accelerometers is not based on differential sensing principle. Although, there exist several vertical axis accelerometer designs that are based on differential sensing, either they suffer from complicated fabrication processes or problems related to implementation of those vertical accelerometer design fabrication processes to the lateral ones.

All problems mentioned above are eliminated with this invention and implementation of its fabrication process to the lateral ones to have a three axis accelerometer.



Quantized Detection in Uplink MIMO with Oversampling



Smart Oversampling Scheme for High Quality Communication

The invention takes samples with a sampling rate which is faster than the symbol rate in time and processes those samples with a near-optimal linear signal processing technique.

Advantages

Connectivity

Users can stay connected over wider regions

High performance

Higher data rate experience

High efficiency

Higher data rates provided with smaller transmission bandwidth

Low cost

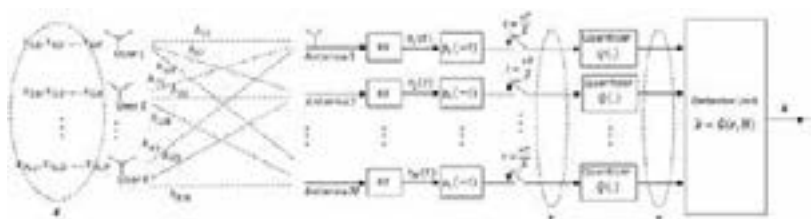
Higher quality of service with low-cost base stations

Stable

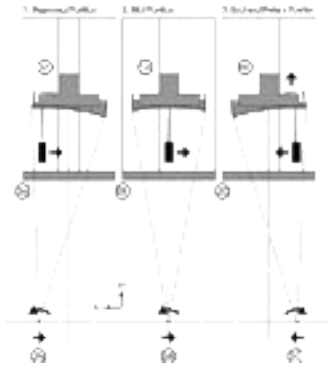
More stable connectivity due to the increase in the number of users that can be served

Enables higher quality communication with feasible/low cost massive MIMO base stations

This invention reduces the necessary number of antennas in new generation low-cost massive MIMO base stations to maintain a certain level of service quality, while providing significant advantages regarding data rate, spectral efficiency, coverage area, and the number of users that can be served by the base station.



Low-stress Stereolithography



Fast and efficient additive manufacturing method

This invention aims to solve the main problems of top-down SLA printers that are currently in the market; the sticky resin tank bottom and up and down movements of the print platform to solve resin flow and separation of model from the resin tank. This method enables a fast and efficient method to continue printing without unnecessary movements while creating a low-stress separation of model and resin tank.

Advantages

The speed gains provided by the tank motion,

The elimination of high forces during layer separation from resin tank,

The continuous rocking movement of the resin tank prevents the particles in the resin to separate,

Eliminates the up-down movements for layer separation of the current state of technology,

Prevents the formation of air bubbles from forming inside the resin as the build platform never exists the resin.

The main solution that the invention provides is enabled with a rocking resin tank that prevents the solidified polymer from sticking to the bottom of the tank. This also prevents unnecessary movements of the printer while enabling a continues printing experience.

The rocking motion of the resin tank enables the solidified resin to separate from the resin tank bottom using a peeling action. This peeling action is only at the location of the solidified line by the laser thus not the whole surface. Currently, methods of top-down SLA use a flexible resin tank bottom that puts a great amount of pressure while the solidified resin separates and this creates failures and unnecessary time-losses during printing.

