OSCILLATORY DISCHARGE 82 pdf

1: Tureng - discharge - Turkish English Dictionary

Oscillatory discharge definition is - an electric discharge in a circuit having sufficient capacitative reactance to result in damped alternating surges of electricity. an electric discharge in a circuit having sufficient capacitative reactance to result in damped alternating surges of electricity.

Physiological Reports published by Wiley Periodicals, Inc. This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited. This article has been cited by other articles in PMC. Abstract The medial prefrontal cortex mPFC is a region of neocortex that plays an integral role in several cognitive processes which are abnormal in schizophrenic patients. In those seven cells, ROB discharge was accurately predicted by the presence of a voltage sag in response to a hyperpolarizing current injection. While the full implications of this work are not yet understood, it may provide important insight into serotonergic modulation of cortical networks. It has been proposed that the mPFC of rodents may be homologous to medial and lateral prefrontal cortex in humans and primates Heidbreder and Groenewegen ; Seamans et al. Subcortically projecting neurons display a prominent sag in response to hyperpolarizing current injection, and a pronounced depolarizing afterpotential DAP immediately following action potentials. Due to their electrophysiological differences e. The mPFC is one of several regions of the brain which has been found to be anatomically and functionally abnormal in schizophrenic patients Honea et al. As the primary output stage of cortical microcircuits, layer 5 pyramidal neurons likely play an integral role in mediating schizophrenic symptoms and the modulation of these neurons likely has major ramifications for global information processing. Although schizophrenia research has typically focused on dopaminergic systems, it is important to examine the role of the serotonergic modulation of cortical networks in the mPFC. Serotonergic neurons from the dorsal raphe nuclei innervate the mPFC and exert topâ€”down control of information processing largely via nonsynaptic volume transmission Seguela et al. Rhythmically recurrent burst discharge has previously been reported as both an intrinsic property of deep layer pyramidal neurons of the mPFC Yang et al. In general, in vitro studies examine spiking behavior over relatively short periods of time â€” msec. All procedures used in this study were approved by the University of Northern Colorado institutional animal care and use committee. Mice were anesthetized with CO2 and rapidly decapitated. Only cells that exhibited thin, overshooting action potentials, and would consistently spike throughout a 60 sec current injection were used in this study. During current injections, amplifier bridge balance was utilized and monitored throughout the experiment. Data were acquired at a 10 kHz sampling rate using pClamp 8. Any drugs that were not used within 3 days of thawing were discarded. For electrophysiology experiments, brain slices were superfused with drug solutions for 5 min prior to any data acquisition. Data analysis Axon binary files recorded in pClamp 8. This method of calculating the Cv of ISImin was used in this context due to its higher sensitivity to bursts over short periods of time. Burst initiation and termination times were verified by visually inspecting data records. This method was used to assess the number of spikes per burst and the percentage of intraburst spikes relative to total evoked spikes.

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2: What is oscillatory discharge

Felix Savary was the first to notice the oscillatory discharge of a Leyden jar connected to an inductor in The easiest way to describe what happens during an oscillatory discharge is to imagine an LC circuit.

The neuronal basis for consciousness by R. One aspect of its neuronal organization that seems particularly central to global function is the rich thalamocortical interconnectivity, and most particularly the recip One aspect of its neuronal organization that seems particularly central to global function is the rich thalamocortical interconnectivity, and most particularly the reciprocal nature of the thalamocortical neuronal loop function. Show Context Citation Context Finkel , " We present a cortical-based model for computing the perceptual salience of contours embedded in noisy images. In our model, horizontal connections mediate context-dependent facilitatory and inhibitory interactions among oriented cells. Strongly facilitated cells undergo temporal synchronization; and perceptual salience is determined by the level of synchronized activity. How does the brain group together different parts of an object into a coherent visual object representation? Different parts of an object may be processed by the brain at different rates and may thus become desynchronized. Perceptual framing is a process that resynchronizes cortical activities corre Perceptual framing is a process that resynchronizes cortical activities corresponding to the same retinal object. A neural network model is presented that is able to rapidly resynchronize desynchronized neural activities. The model provides a link between perceptual and brain data. Model properties quantitatively simulate perceptual framing data, including psychophysical data about temporal order judgments and the reduction of threshold contrast as a function of stimulus length. Such a model has earlier been used to explain data about illusory contour formation, texture segregation, shape-from-shading, 3-D vision, and cortical receptive fields. The model hereby shows how many data may be understood as manifestations of a cortical grouping process that can rapidly res Neurophysiol , " Spatiotemporal patterns in the Hz domain progressively differed from the invariant patterns with decreasing frequency. Intermediate-level visual representations and the construction of surface perception by Paul Sajda, Leif H. Finkel - Journal of Cognitive Neuroscience , " Visual processing has often been divided into three stages- sentation of ownership provides a central locus for visual early, intermediate, and high level vision, which roughly corre- integration. Our simulations show the ability to segment real spond to the sensation, perception, and cognition of t Our simulations show the ability to segment real spond to the sensation, perception, and cognition of the visual and illusory images in a manner consistent with human per-world. In this paper, we present a network-based model of ception. In addition, through ownership, other processes such intermediate-level vision that focuses on how surfaces might as depth, transparency, and surface completion can interact be represented in visual cortex. The interspike intervals in steady-state neuron firing are assumed to be i. In the simplest model discussed, each interval is assumed to be the sum of a random neuron refractory period and a statistically independent interval due to a stationary external process, whos In the simplest model discussed, each interval is assumed to be the sum of a random neuron refractory period and a statistically independent interval due to a stationary external process, whose statistics are assumed known. The power spectral density hence the autocorrelation of the composite neuron-firing renewal process is derived from the known spectrum of the external process and from the unknown spectrum of the neuron-refraction process. The results are applied to spike trains recorded in a previous study [2] of single neurons in visual cortex of awake monkey. Two models are demonstrated that may produce peaks in the power spectrum near 40 Hz. This is largely due to the reports of stimulus-induced oscillation near 40 Hz in neural activity recorded in the visual cortex of the anesthetized cat [4], [6], [7], [5] and the awake monkey [Finkel - In " It has been suggested that long-range intrinsic connections in striate cortex may play a role in contour extraction Gilbert et al. A number of recent physiological and psychophysical studies have examined the possible role of long range connections in the modulation of contrast detection th A number of recent physiological and psychophysical studies have examined the possible role of long range connections in the modulation of contrast detection thresholds Polat and Sagi, ,; Kapadia et al. We have developed a network architecture based on the anatomical connectivity of striate cortex, as well as

the temporal dynamics of neuronal processing, that is able to reproduce the observed experimental results. The network has been tested on real images and has applications in terms of identifying salient contours in automatic image processing systems. Visual stimulusâ€”dependent changes in interhemispheric EEG coherence in humans by D. Visual stimulusâ€”dependent changes in interhemispheric EEG coher-ence in ferrets. In recent years, the analysis of the coherence between signals recorded from the scalp [electroencephalographic EEG coherence] has been used to assess the functional properties of In recent years, the analysis of the coherence between signals recorded from the scalp [electroencephalographic EEG coherence] has been used to assess the functional properties of cortico-cortical connections, both in ani-mal models and in humans. However, the experimental validation of this technique is still scarce. Therefore we applied it to the study of the callosal connections between the visual areas of the two hemispheres, because this particular set of cortico-cortical connections can be activated in a selective way by visual stimuli. Indeed, in primary and in low-order secondary visual areas, callosal axons interconnect se-lectively regions, which represent a narrow portion of the visual field straddling the vertical meridian and, within these regions, neurons that prefer the same stimulus orientation. Thus only isooriented stimuli located near the vertical meridian are expected to change interhemi- Identification of Salient Contours in Cluttered Images by Shih-cheng Yen, Leif H. We present a model of contour extraction in which the perceptual salience of contours arises from long-range interactions between orientation-selective filters. Ullman [19], Zucker [22, 23] and colleagues have previously shown that salient contours may be extracted from noisy images by using a numbe Ullman [19], Zucker [22, 23] and colleagues have previously shown that salient contours may be extracted from noisy images by using a number of heuristic features. Our algorithm is based on cortical mechanisms, and simulations show close agreement with results from recent anatomical, physiological and psychophysical studies including recent results of Field et al. The performance of the algorithm is demonstrated on a range of psychophysical stimuli and real images. Introduction Contour extraction has been the focus of many previous computational studies, yet it remains a difficult problem in practice. We use neural oscillators only as a simple functional means of computing synchronization and make no assumption about the functional role of neural oscillations in cortex. Oscillators are coupled to other oscillators with which they have strong, reciprocal, facilitated connections, and which are also within a threshold distance, r. This threshold is determined by the Synchronization of neural signals has been proposed as a temporal coding scheme representing cooperated computation in distributed cortical networks. Previous theoretical studies in that direction mainly focused on the synchronization of coupled oscillatory subsystems and neglected more complex dyna Previous theoretical studies in that direction mainly focused on the synchronization of coupled oscillatory subsystems and neglected more complex dynamical modes, that already exist on the single-unit level. In the present work we study the parameterized time-discrete dynamics of two coupled recurrent networks of graded neurons. Conditions for the existence of partially synchronized dynamics of these systems are derived, referring to a situation where only subsets of neurons in each sub-network are synchronous. The coupled networks can have different architectures and even a different number of neurons. Periodic as well as quasi-periodic and chaotic attractors constrained to a manifold M of synchronized components are observed. Examples are discussed for coupled 3-neuron networks having different architectures, and for coupled 2-neuron and 3-neuron networks. Partial synchronization of different degrees is demon-strated by numerical results for selected sets of parameters. In conclusion, the results show that synchronization phenomena far beyond completely synchronized oscillations can occur even in simple coupled networks. The type of the synchronization depends in an intricate way on stimuli, history and connectivity as well as other parameters of the network. Specific in-puts can further switch between di erent operational modes in a complex way, suggesting a similarly rich spatio-temporal behavior in real neural systems.

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3: Oscillatory Discharge | Definition of Oscillatory Discharge by Merriam-Webster

interactions and oscillatory discharge: oscillations were just as likely to occur with nonoptimal as with optimal binocular stimuli. For 98 binocular cells that exhibited oscillatory discharge, monoc-.

Kuramoto model The Kuramoto model of coupled phase oscillators [36] is one of the most abstract and fundamental models used to investigate neural oscillations and synchronization. It captures the activity of a local system e. The Kuramoto model is widely used to study oscillatory brain activity and several extensions have been proposed that increase its neurobiological plausibility, for instance by incorporating topological properties of local cortical connectivity. Simulations using the Kuramoto model with realistic long-range cortical connectivity and time-delayed interactions reveal the emergence of slow patterned fluctuations that reproduce resting-state BOLD functional maps, which can be measured using fMRI. In addition, they may show oscillatory responses to perceptual input or motor output. Some types of neurons will fire rhythmically in the absence of any synaptic input. Likewise, brain-wide activity reveals oscillatory activity while subjects do not engage in any activity, so-called resting-state activity. These ongoing rhythms can change in different ways in response to perceptual input or motor output. Oscillatory activity may respond by increases or decreases in frequency and amplitude or show a temporary interruption, which is referred to as phase resetting. In addition, external activity may not interact with ongoing activity at all, resulting in an additive response. Oscillatory responses The frequency of ongoing oscillatory activity is increased between t1 and t2. The amplitude of ongoing oscillatory activity is increased between t1 and t2. The phase of ongoing oscillatory activity is reset at t1. Activity is linearly added to ongoing oscillatory activity between t1 and t2. Ongoing activity[edit] Spontaneous activity is brain activity in the absence of an explicit task, such as sensory input or motor output, and hence also referred to as resting-state activity. It is opposed to induced activity, i. The term ongoing brain activity is used in electroencephalography and magnetoencephalography for those signal components that are not associated with the processing of a stimulus or the occurrence of specific other events, such as moving a body part, i. Spontaneous activity is usually considered to be noise if one is interested in stimulus processing; however, spontaneous activity is considered to play a crucial role during brain development, such as in network formation and synaptogenesis. Spontaneous activity may be informative regarding the current mental state of the person e. Certain types of oscillatory activity, such as alpha waves , are part of spontaneous activity. Statistical analysis of power fluctuations of alpha activity reveals a bimodal distribution, i. Indeed, EEG studies suggest that visual perception is dependent on both the phase and amplitude of cortical oscillations. For instance, the amplitude and phase of alpha activity at the moment of visual stimulation predicts whether a weak stimulus will be perceived by the subject. Frequency changes are also commonly observed in central pattern generators and directly relate to the speed of motor activities, such as step frequency in walking. However, changes in relative oscillation frequency between different brain areas is not so common because the frequency of oscillatory activity is often related to the time delays between brain areas. Phase resetting[edit] Phase resetting occurs when input to a neuron or neuronal ensemble resets the phase of ongoing oscillations. Phase resetting is fundamental for the synchronization of different neurons or different brain regions [11] [28] because the timing of spikes can become phase locked to the activity of other neurons. Phase resetting also permits the study of evoked activity, a term used in electroencephalography and magnetoencephalography for responses in brain activity that are directly related to stimulus -related activity. Evoked potentials and event-related potentials are obtained from an electroencephalogram by stimulus-locked averaging, i. As a consequence, those signal components that are the same in each single measurement are conserved and all others, i. That is, event-related potentials only reflect oscillations in brain activity that are phase -locked to the stimulus or event. Evoked activity is often considered to be independent from ongoing brain activity, although this is an ongoing debate. Induced activity refers to modulation in ongoing brain activity induced by processing of stimuli or movement preparation. Hence, they reflect an indirect response in contrast to evoked responses. A well-studied type of induced activity is amplitude change in oscillatory activity. For instance, gamma activity often increases during increased mental activity such as

during object representation. Induced activity generally reflects the activity of numerous neurons: Increases in oscillatory activity are therefore often referred to as event-related synchronization, while decreases are referred to as event-related desynchronization. For example, when a person looks at a tree, visual cortex neurons representing the tree trunk and those representing the branches of the same tree would oscillate in synchrony to form a single representation of the tree. This phenomenon is best seen in local field potentials which reflect the synchronous activity of local groups of neurons, but has also been shown in EEG and MEG recordings providing increasing evidence for a close relation between synchronous oscillatory activity and a variety of cognitive functions such as perceptual grouping. Cardiac pacemaker Cells in the sinoatrial node , located in the right atrium of the heart, spontaneously depolarize approximately times per minute. Hence, these cells generate the normal sinus rhythm and are called pacemaker cells as they directly control the heart rate. In the absence of extrinsic neural and hormonal control, cells in the SA node will rhythmically discharge. The sinoatrial node is richly innervated by the autonomic nervous system , which up or down regulates the spontaneous firing frequency of the pacemaker cells. Central pattern generator[edit] Main article: Central pattern generator Synchronized firing of neurons also forms the basis of periodic motor commands for rhythmic movements. These rhythmic outputs are produced by a group of interacting neurons that form a network, called a central pattern generator. Central pattern generators are neuronal circuits thatâ€”when activatedâ€”can produce rhythmic motor patterns in the absence of sensory or descending inputs that carry specific timing information. Examples are walking , breathing , and swimming , [57] Most evidence for central pattern generators comes from lower animals, such as the lamprey , but there is also evidence for spinal central pattern generators in humans. Neural coding Neuronal spiking is generally considered the basis for information transfer in the brain. For such a transfer, information needs to be coded in a spiking pattern. Different types of coding schemes have been proposed, such as rate coding and temporal coding. Neural oscillations could create periodic time windows in which input spikes have larger effect on neurons, thereby providing a mechanism for decoding temporal codes. Binding problem Synchronization of neuronal firing may serve as a means to group spatially segregated neurons that respond to the same stimulus in order to bind these responses for further joint processing, i. Purely theoretical formulations of the binding-by-synchrony hypothesis were proposed first, [61] but subsequently extensive experimental evidence has been reported supporting the potential role of synchrony as a relational code. These experiments showed that groups of spatially segregated neurons engage in synchronous oscillatory activity when activated by visual stimuli. Gilles Laurent and colleagues showed that oscillatory synchronization has an important functional role in odor perception. Perceiving different odors leads to different subsets of neurons firing on different sets of oscillatory cycles. Motor coordination Oscillations have been commonly reported in the motor system. In support, it was shown that these movement discontinuities are directly correlated to oscillatory activity in a cerebello-thalamo-cortical loop, which may represent a neural mechanism for the intermittent motor control. Memory Neural oscillations, in particular theta activity, are extensively linked to memory function. Theta rhythms are very strong in rodent hippocampi and entorhinal cortex during learning and memory retrieval, and they are believed to be vital to the induction of long-term potentiation , a potential cellular mechanism for learning and memory. Coupling between theta and gamma activity is thought to be vital for memory functions, including episodic memory. Sleep Sleep is a naturally recurring state characterized by reduced or absent consciousness and proceeds in cycles of rapid eye movement REM and non-rapid eye movement NREM sleep. Sleep stages are characterized by spectral content of EEG: Development[edit] Neural oscillations may play a role in neural development. For example, retinal waves are thought to have properties that define early connectivity of circuits and synapses between cells in the retina. These pathological oscillations often consist of an aberrant version of a normal oscillation. For example, one of the best known types is the spike and wave oscillation, which is typical of generalized or absence epileptic seizures, and which resembles normal sleep spindle oscillations. Tremor A tremor is an involuntary, somewhat rhythmic, muscle contraction and relaxation involving to-and-fro movements of one or more body parts. It is the most common of all involuntary movements and can affect the hands, arms, eyes, face, head, vocal cords, trunk, and legs. Most tremors occur in the hands. In some people, tremor is a symptom of another neurological disorder. Many

different forms of tremor have been identified, such as essential tremor or Parkinsonian tremor. It is argued that tremors are likely to be multifactorial in origin, with contributions from neural oscillations in the central nervous systems, but also from peripheral mechanisms such as reflex loop resonances. Epilepsy Epilepsy is a common chronic neurological disorder characterized by seizures. Thalamocortical dysrhythmia In thalamocortical dysrhythmia TCD , normal thalamocortical resonance is disrupted. The thalamic loss of input allows the frequency of the thalamo-cortical column to slow into the theta or delta band as identified by MEG and EEG by machine learning. Clinical endpoints[edit] Neural oscillations are sensitive to several drugs influencing brain activity; accordingly, biomarkers based on neural oscillations are emerging as secondary endpoints in clinical trials and in quantifying effects in pre-clinical studies.

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4: Oscillatory Discharge

Find out information about oscillatory discharge. Alternating current of gradually decreasing amplitude which, under certain conditions, flows through a circuit containing inductance, capacitance, and.

This article has been cited by other articles in PMC. Abstract Background The diastolic oscillatory after-potential Vos and pre-potential ThVos play an essential role in the pacemaker mechanism of sino-atrial node SAN. The aim of this study was to investigate whether these oscillatory potentials are also involved in adrenergic control of SAN discharge. The actions of adrenergic agonists on oscillatory potentials were studied by means of a microelectrode technique. Results In non-spontaneous SAN, norepinephrine NE decreased the resting potential into a voltage range "oscillatory zone" where increasingly larger ThVos appeared and initiated spontaneous discharge. In slowly discharging SAN, NE gradually increased the rate by increasing the amplitude and slope of earlier-occurring ThVos and of Vos until these oscillations fused with initial diastolic depolarization DD1. In the presence of NE, sudden fast rhythms were initiated by large Vos that entered a more negative oscillatory zone and initiated a large ThVos. Recovery from NE exposure involved the converse changes. The results provide evidence for novel mechanisms by which the SAN dominant pacemaker activity is initiated and enhanced by adrenergic agonists. Background The mechanisms by which adrenergic agonists increase the rate of the sino-atrial node SAN are not agreed upon [1 - 3]. In part, this is the result of the disagreement about the SAN dominant pacemaker mechanism [see [4 , 5]], since adrenergic neuromediators would be expected to change SAN rate by acting on dominant pacemakers. Adrenergic neuromediators affect several voltage- and time-dependent currents purported to be involved in SAN dominant pacemaker mechanism, including the calcium current ICaL [6 - 8], the delayed rectifier current IK [1 , 9 , 10] and the hyperpolarization-activated current If [2]. This complex state of affairs is complicated by the fact that in addition to diastolic depolarization, DD two oscillatory potentials the after-potential Vos and the pre-potential ThVos are obligatory components of SAN dominant pacemaker mechanism [15 - 18]. In Tyrode solution, as soon as the maximum diastolic potential MDP of SAN dominant pacemakers is reached, the membrane potential turns around into a DD whose slope is similar to that of the preceding final phase 3 repolarization. Vos is obligatorily superimposed on the initial diastolic depolarization DD1 whereas ThVos appears gradually later when the late DD DD2 enters a less negative voltage range "oscillatory zone". Our aim was to test the hypothesis that adrenergic agonists increase the SAN rate also by modifying the oscillatory potentials. The results obtained show that adrenergic agonists initiate spontaneous discharge and increase SAN rate gradually or suddenly by modifying in different ways Vos and ThVos as well as the resting potential and DD. Methods The experiments conform to the principles of national and international ethical guidelines. The experimental protocols were approved by the local Animal Care and Use Committee. The Methods have been reported in detail [15 - 18]. Once the respiration had stopped, the heart was rapidly excised and placed in a Petri dish filled with oxygenated Tyrode solution. The sino-atrial node was separated from the surrounding red-brown atrial tissue. Membrane potentials were recorded by means of glass microelectrodes filled with 3 M KCl and coupled to a Dagan probe and to a Dagan model operational amplifier. The traces were displayed on a Tektronix model storage oscilloscope and recorded on paper on a 3-channel chart recorder Gould Brush The use of the guinea-pig isolated SAN permitted to abolish the electrotonic interference from atrial muscle, since the SAN is made of sinus cells throughout its thickness [23]. Thus, the cells studied were pacemaker cells with dominant characteristics. Secondary pacemakers have a more negative diastolic potential, abrupt transition between diastolic potential and upstroke, much larger AP, less steep DD and no ThVos, since the more negative diastolic potential is negative to the oscillatory zone [e. The abbreviations Vos and ThVos are used for both singular and plural. The early diastolic depolarization is referred to as DD1 and the late diastolic depolarization as DD2. The presence and amplitude of Vos was identified by its peak during DD1. The maximum diastolic potential MDP and the resting potential are said to decrease when becoming less negative. Results Initiation of spontaneous discharge by norepinephrine In Fig. The AP was followed by a Vos leftward oblique arrow. The dash line emphasizes the transition between the peak of Vos and the subsequent DD.

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ThVos appeared progressively sooner subsequent rightward oblique arrows and at more negative potentials. The traces labeled with an empty and a filled star were superimposed in inset 1 and show that NE made ThVos shaded area begin early in diastole and at a more negative value negative shift of the oscillatory zone. By occurring earlier in diastole, ThVos gradually increased the rate. At the same time, Vos size increased short bars.

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5: Neural oscillation - Wikipedia

Alternating current of gradually decreasing amplitude which, undercertain conditions, flows through a circuit containing inductance,capacitance, and resistance when a voltage is applied is known.

The apparatus comprises a web support designed to receive a fibrous web thereon and to carry it in a machine direction; at least one pulse generator designed to produce oscillatory flow-reversing air or gas; and at least one gas-distributing system in fluid communication with the pulse generator for delivering the oscillatory flow-reversing air or gas to the web. The gas-distributing system terminates with a plurality of discharge outlets juxtaposed with the web support such that the web support and the discharge outlets form an impingement distance therebetween, the plurality of the discharge outlets comprising a predetermined pattern defining an impingement area of the web. More particularly, the present invention is concerned with dewatering of fibrous webs. For example, paper webs may be produced according to commonly-assigned U. Paper webs may also be made using through-air drying processes as described in commonly-assigned U. The disclosures of the foregoing patents are incorporated herein by reference. Removal of water from the paper in the course of paper-making processes typically involves several steps. Because of such a great amount of water needed to be removed, water removal is one of the most energy-intensive unit operations in industrial paper-making processes. According to one study, paper-making is the leading industry in total energy consumption for drying, using more than 3. Therefore, more efficient methods of water removal in the paper-making processes may provide significant benefits for the paper-making industry, such as increased machine capacity and reduced operational costs. It is known in the papermaking arts to use steady-flow impingement gas and cylinder dryers to dry a paper web. See, for example, Polat et al. Typically, impingement hoods are used together with Yankee cylinder dryers for tissue products. In webs having relatively low basis weights of about pounds per square feet, water is removed in about 0. The drying rates of paper products having relatively heavier basis weights are considerably slower. For example, newsprint, having a basis weight of about 30 pounds per square feet, has the evaporation rate of about 5 pounds per hour per square feet on the cylinder dryers. See, for example, P. It is also known to use a sonic energy, such as that generated by steam jet whistles, to facilitate removal of water from various products, including paper. Generating the acoustic energy in accordance with the prior art by such means as noise generators, steam whistles, and the like requires very powerful acoustic sources and leads to a significant power consumption. An additional equipment, such as auxiliary compressors to pressurize air, and amplifiers to generate the desired sound pressure, may also be necessary to reach a desired drying effect. It is believed that an oscillatory flow-reversing impingement air or gas having relatively low frequencies is an effective means for increasing, relative to the prior art, heat and mass transfer rates in papermaking processes. Pulse combustion technology is a known and viable commercial method of enhancing heat and mass transfer in thermal processes. Commercial applications include industrial and home heating systems, boilers, coal gassification, spray drying, and hazardous waste incineration. For example, the following U. Patents disclose several industrial applications of pulse combustion: Eibeck et al, and published in Combustion Science and Technology, , Vol. The article reports enhancements in convective heat transfer of a factor of up to 2. In addition, it is believed that the oscillatory flow-reversing impingement enables one to achieve a substantially uniform drying of the differential-density webs produced by the current assignee and referred to herein above. In either instance, the control over the distribution of the oscillatory flow-reversing air or gas throughout the surface of the web, and particularly in the cross-machine-direction, is crucial to the effectiveness of the process of removing water from the web. Such a width, coupled with a high-speed movement of the web creates certain difficulties of controlling presumably uniform distribution of the oscillatory gas throughout the surface of the web. Existing apparatuses for generating oscillatory flow-reversing air or gas, such as, for example, pulse combustors, are not well adapted, if at all, to generate a required substantially uniform oscillatory field of the flow-reversing air or gas across a relatively large area. Accordingly, it is an object of the present invention to provide a process and an apparatus for removing water from fibrous webs, using the oscillatory flow-reversing impingement gas. It is another object of the present

invention to provide a gas-distributing system allowing one to effectively control the distribution of the oscillatory flow-reversing air or gas throughout the surface of the web. It is still another object of the present invention to provide a gas-distributing system that creates a substantially uniform application of the oscillatory flow-reversing air or gas onto the web. The apparatus and the process of the present invention may be used at various stages of the overall papermaking process, from a stage of forming an embryonic web to a stage of post-drying. In its process aspect, the present invention comprises the following steps: Preferably, the oscillatory flow-reversing gas is impinged onto the web in a predetermined pattern defining an impingement area of the web. The first step of providing a fibrous web may be preceded by steps of forming such a web, including the steps of providing a plurality of papermaking fibers. The present invention also contemplates the use of the web formed by dry-air-laid processes or the web that has been rewetted. The web may have a non-uniform moisture distribution prior to water removal by the process and the apparatus of the present invention, i. A water-removing apparatus of the present invention has a machine direction and a cross-machine direction perpendicular to the machine direction. The apparatus of the present invention comprises: The gas-distributing system terminates with a plurality of discharge outlets juxtaposed with the web support or with the web when the web is disposed on the web support. The web support and the discharge outlets form an impingement region therebetween. The oscillatory flow-reversing gas may be impinged onto the web to provide a substantially even distribution of the gas throughout the impingement area of the web. Alternatively, the oscillatory gas may be impinged onto the web to provide an uneven distribution of the gas throughout the impingement area of the web thereby allowing control of moisture profiles of the web. Preferably, an acoustic pressure generated by the pulse generator is converted to a cyclical movement of large amplitude, comprising negative cycles alternating with positive cycles, the positive cycles having greater momentum and cyclical velocity relative to the negative cycles, as will be described in greater detail below. One preferred pulse generator comprises a pulse combustor, generally comprising a combustion chamber, an air inlet, a fuel inlet, and a resonance tube. The tube operates as a resonator generating standing acoustic waves. The resonance tube is in further fluid communication with a gas-distributing system. The gas-distributing system is designed such as to minimize, and preferably avoid altogether, disruptive interference which may adversely affect a desired mode of operation of the pulse combustor or oscillatory characteristics of the flow-reversing gas generated by the pulse combustor. The gas-distributing system delivers the flow-reversing impingement air or gas onto the web, preferably through a plurality of discharge outlets, or nozzles. The preferred frequency of the oscillatory flow-reversing impingement air or gas is in a range of from about 15 Hz to about Hz. If the pulse generator comprises the pulse combustor, the preferred frequency is from about 75 Hz to about Hz. A Helmholtz-type resonator may be used in the pulse generator of the present invention. Typically, the Helmholtz-type pulse generator may be tuned to achieve a desired sound frequency. Another embodiment of the pulse generator comprises an infrasonic device. The infrasonic device comprises a resonance chamber in fluid communication with an air inlet through a pulsator. The pulsator generates an oscillating air having infrasound low frequency pressure which then is amplified in the resonance chamber and in the resonance tube. If desired, the apparatus comprising the infrasonic device may have a means for heating the oscillatory flow-reversing air generated by the infrasonic device. The oscillatory flow-reversing impingement air or gas has two components: An average amplitude of the positive cycles is a positive amplitude, and an average amplitude of the negative cycles is a negative amplitude. During the positive cycles, the impingement gas has a positive velocity directed in a positive direction towards the web disposed on the web support; and during the negative cycles, the impingement gas has a negative velocity directed in a negative direction. The positive direction is opposite to the negative direction, and the positive velocity is opposite to the negative velocity. The positive velocity component is greater than the negative velocity component, and the mean velocity has the positive direction. The pulse combustor produces an intense acoustic pressure, typically in the order of dB, inside the combustion chamber. This acoustic pressure reaches its maximum level in the combustion chamber. Due to the open end of the resonance tube, the acoustic pressure is reduced at the exit of the resonance tube. This drop in the acoustic pressure results in a progressive increase in cyclical velocity which reaches its maximum at the exit of the resonance tube. In the preferred Helmholtz-type pulse generator the acoustic pressure is minimal at the exit

of the resonance tubeâ€”in order to achieve a maximal cyclical velocity in the exhaust flow of oscillatory impingement gases. The decreasing acoustic pressure beneficially reduces noise typically associated with sonically enhanced processes of the prior art. One way of accomplishing it is to cause the flow of the oscillatory gas from the gas-distributing system be substantially equally split and impinged onto the drying surface of the web through a network of the discharge outlets. Therefore, the apparatus of the present invention is designed to discharge the oscillatory flow-reversing impingement air or gas onto the web according to a pre-determined, and preferably controllable, pattern. A pattern of distribution of the discharge outlets may vary. One preferred pattern of distribution comprises a non-random staggered array. The discharge outlets of the gas-distributing system may have a variety of shapes, including but not limited to: In the preferred embodiment a means for controlling the impingement distance may be provided, such as, for example, conventional manual mechanisms, as well as automated devices, for causing the outlets of the gas-distributing system and the web support to move relative to each other, thereby changing the impingement distance. Prophetically, the impingement distance may be automatically adjustable in response to a signal from a control device, measuring at least one of the parameters of the dewatering process or one of the parameters of the web. In the preferred embodiment, the impingement distance may vary from about 0. The impingement distance defines an impingement region, i. In the preferred embodiment, a ratio of the impingement distance Z to the equivalent diameter D of the discharge outlet i. In one embodiment, the gas-distributing system comprises at least one blow box. The blow box comprises a bottom plate having the plurality of the discharge outlets therethrough. The blow box may have a substantially planar bottom plate. Alternatively, the bottom plate of the blow box may have a non-planar or curved shape, such as, for example, a convex shape, or a concave shape. In one embodiment of the blow box, a generally convex bottom plate is formed by a plurality of sections. An angled application of the oscillating flow-reversing air or gas may be beneficially used in the present invention. Angles formed between the general surface of the web support or a surface of the impingement area E of the web and the positive directions of the oscillating streams of air or gas through the discharge outlet may range from almost 0 degree to 90 degrees. These angles may be oriented in the machine direction, in the cross-machine direction, and in the direction intermediate the machine direction and the cross-machine direction. A plurality of the gas distributing systems may be used across the width of the web. This arrangement allows a greater flexibility in controlling the conditions of the web-dewatering process across the width of the web. For example, such arrangement allows one to control the impingement distance individually for differential cross-machine directional portions of the web. If desired, the individual gas-distributing systems may be distributed throughout the surface of the web in a non-random, and preferably staggered-array, pattern. The oscillatory field of the flow-reversing impingement gas may beneficially be used in combination with a steady-flow non-oscillatory impingement gas impinged onto the web. One preferred embodiment comprises sequentially-alternating application of the oscillatory flow-reversing gas and the steady-flow gas. One of or both the oscillatory gas and the steady-flow gas can comprise jet streams having the angled position relative to the web support. The web support may include a variety of structures, for example, papermaking band or belt, wire or screen, a drying cylinder, etc. In the preferred embodiment, the web support travels in the machine direction at a velocity of from feet per minute to 10, feet per minute. More preferably, the velocity of the web support is from 1, feet per minute to 10, feet per minute.

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