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behavior of coupled nonlinear oscillators in d-dimensional lattice in relation with dynamic surface growth model such as Edwards-Wilkinson (EW) equation. Phase synchronization and frequency entrainment are probed, where those behaviors are examined and estimated through the previous corresponding results of the surface roughness measure W and the height-height correlation function C(r,t), respectively. The probability density is numerically obtained, and from it the ordering behavior is examined. It is found that the effective coupling strength for d=2 is increased as K_eff ~ ln L with the system size L. The ordering behavior for d=3 is also discussed.

F-07(초) **Entropic Resonance in Globally-Coupled Ising Model** 김범준, 최무영[1](*아주대. [1]서울대.*) The entropic sampling dynamics of the globally coupled Ising model in the presence of the oscillating external magnetic field is numerically investigated. When the driving frequency Ω is small enough, the resonance between the magnetization and the external magnetic field is observed, which we call the entropic resonance. The intrinsic relaxation time scale in the entropic sampling dynamics is also measured in the absence of external magnetic field, and the time-scaling matching between the intrinsic and extrinsic time scales is used to explain the disappearance of the entropic resonance as the system size becomes larger.

F-08 **위상모델을 이용한 신경망계에서의 동기화 연구** 황동욱, 이상커[1], 국형태[2], 한승기(*충북대, 물리학과. [1]포항공대, 물리학과. [2]경원대, 물리학과.*) 뇌의 활동 중에서 감마(30~70Hz)와 베타(12~29Hz)영역의 리듬은 주의, 지각 그리고 인지에 관련되어 있다고 알려져 있다. 이러한 활동은 시간지연을 갖고 신호가 전달되는 다른 두 부분의 뉴런들이 동기화 과정에 대한 이해가 매우 중요하다. 동기화 과정을 연구하기 위하여, 각 뉴런을 대표하는 많은 변수로 기술된 모델을 직접 연구하지 않고 위상이라는 하나의 변수로 치환하여 상호작용을 연구하는 위상모델을 적용하였다. 위상모델을 이용하여 흥분성 뉴런과 억제성 뉴런의 조합으로 된 계가 여러 시냅스 연결을 통해 서로 상호작용 할 때, 각각의 시냅스 결합에 따라 위상고정된 상태의 안정성을 위상차의 함수로 구하였다. 이러한 안정성 함수의 선형결합을 통하여 각 결합의 역할을 알 수 있었고, 전산시늉모델과 비교함으로써 위상모델의 타당성을 확인하였다. 또한, 시냅스 연결이 시간지연을 갖는 경우에도 적용하여 위상모델이 시간지연을 갖는 결합에서도 잘 적용됨을 확인하였다

F-P001 **Jamming Transition in Highly Dense Granular System under Vertical Vibration** 문종균, 김기범, 박종진, 김형국, 박혁규(*부산대학교 물리학과.*) The dynamics of the jamming transition in 3D granular system under vertical vibration is studied using diffusing-wave spectroscopy. When the maximum acceler- ation of the external vibration is large, the granular system behaves like a fluid, with the dynamic correlation function G(t) relaxing rapidly. As the acceleration of vibration approaches the gravitational acceleration g, the relaxation of G(t) slows down dramatically, and eventually stops. Thus, the system undergoes a phase transition and behaves like a solid. A theory of supercooled liquids close to the glass transition is used to explain the relaxation data.

F-P002 **Effect of Asymmetry on Blow-Out Bifurcations in Coupled Chaotic Systems** 김상윤, 임우창(*강원대.*) We investigate the effect of asymmetry of coupling on blow-out bifurcations in a system of coupled one-dimensional maps by varying a parameter a tuning the "degree" of asymmetry from symmetric coupling ($a=0$) to unidirectional coupling ($a=1$). For the case of symmetric coupling, an asynchronous hyperchaotic attractor with a positive second Lyapunov exponent is born through a blow-out bifurcation. However, as the parameter a passes a threshold value a^*, a transition from hyperchaos to chaos occurs. Hence, for $a^*<a\leq 1$ an asynchronous chaotic attractor with a negative second Lyapunov exponent appears. It is found that the sign of the second Lyapunov exponent of the newly-born asynchronous attractor, exhibiting on-off intermittency, is determined through competition between its laminar and bursting components. When the "strength" (i.e., a weighted second Lyapunov

exponent) of the bursting component is larger (smaller) than that of the laminar component, an asynchronous hyperchaotic (chaotic) attractor appears. Similar results are found in examples of higher dimensional invertible systems, in particular, for coupled Henon maps and coupled parametrically forced pendula.

F-P003 **Chaotic bursting as chaotic itinerancy in coupled neural oscillators** 한승기, D. Postnov(*충북대학교, 물리학과.*) We show that chaotic bursting activity observed in coupled neuraloscillators is a kind of chaotic itinerancy. In neuronal systemwith phase deformation along the trajectory, diffusive coupling-induces dephasing effect. Because of this effect, an anti-phasesynchronized solution is stable for weak coupling, while anin-phase solution is stable for very strong coupling. Forintermediate coupling, a chaotic bursting activity is generated.It is a mixture of three different states: an anti-phase firingstate, an in-phase firing state, and a non-firing resting state.As we construct numerically the deformed torus manifold underlingthe chaotic bursting state, it is shown that the three unstablestates are connected to give a rise to a global chaotic itinerancystructure. Thus we claim that chaotic itinerancy provides analternative route to chaos via torus breakdown.

F-P004 **Understanding of visual map formations by analogy with vortex dynamics** 조명원, 김승환(*포항공대 물리학과.*) We propose a general method for generation of the visual cortex map including orientation and ocular dominance columns. Based on the known cortical structure, we build an anisotropic Heisenberg model with long-range lateral interactions of a Mexican hat type. This spin Hamiltonian model allows an interpretation of the map formation in the visual cortex in terms of the pattern formation in relaxation dynamics of spins. In particular, we predict various phenomena of self-organization in ocular and orientation map formations including the pinwheel annihilation and its dependency on boundary conditions and the columnar wave vector.

F-P005 취소

F-P006 취소

F-P007 **달팽이관의 소리인식 시늉내기** 노경보, 문희태(*한국과학기술원 물리학과.*) Sound perception can be understood with nonlinear oscillator model of cochlea which is self-tuned near Hopf bifurcation. This model enables us to understand many strange features. Neural coding mechanism can be interpreted as mapping histogram of inter-spike intervals. We included inter-firing limit of neural pulse in which neuron can not response to external stimulus and could find parameter change may cause complexity in neural pulse signal.

F-P008 **가중치를 갖는 행위자 기초 모형을 이용한 금융시계열 분석 (Financial Time Series Analysis on Weighted Agent-Based Model)** 양재석(J.-S. Yang), 문희태(H.-T. Moon)(*한국과학기술원(KAIST) 물리학과.*) We simulate financial time series using weighted agent-based model. In our model weight is used for two ways. One is the influence of the information to other agents and the other is the amount of wealth. In both case the distribution of agents' weight is important to determine properties of financial market. In our model wieght is evolving as iterating this system. We observe the change of the distribution of agents' weight and fine that the distribution of agents' weight is evolving to the power-law distribution in any initial conditions.

F-P009 **Herd Behavior of the Return in the Korean Financial Market** 김경식, 윤성민[1], 김엽[2](*부경대, 물리학과. [1]부경대, 경제학부. [2]경희대, 물리학과.*) The herd behaviors of the return for the KOSPI and the won-dollar exchange rate are investigated in Korean financial market. The probability distributions of the return for three types of herding parameter is found to scale as a power law R^{-alpha} with the exponents $ alpha=2.4$(the KOSPI) and 2.2(the won-dollar exchange rate). For our case since the active state of