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**F-1(초)**

**Wavelet을 이용한 시계열 분석** 김상락(경기대) Wavelet과 Wavelet 변환에 대해 소개하고, Wavelet 변환을 이용한 시계열 분석 방법에 대해 살펴본다. 최근 Wavelet 변환은 Fourier 변환의 하나의 대안으로 크게 관심을 끌고 있다. 우리는 여기서 Fourier 변환으로서는 알아낼 수 없는 시계열이 가진 특성을 알아내거나, 시계열이 가지고 있는 잡음을 줄이는 것에 대해 알아본다.

**F-2(초)**

**Synchronization of diffusively coupled oscillators near the homoclinic bifurcation** D. Postnov (Saratov State University, Russia), 한승기(충북대), 국형태(경원대) It has been known that a diffusive coupling between two limit cycle oscillations typically leads to the inphase synchronization and also that it is the only stable state in the weak coupling limit. Recently, however, it has been shown that the coupling of the same nature can result in a different synchronization behavior when the limit cycles are close to the homoclinic bifurcation, which often occurs especially for the neuronal oscillators. In this paper we propose a generic physical model by modifying the van der Pol equation with which one may readily observe changes in the synchronization behaviors between the distinctive regimes. The dephasing mechanism for the latter case is analysed both qualitatively and quantitatively in the weak coupling limit. A general form of coupling is introduced and the synchronization behavior over a wide range of the coupling parameters is explored to construct the phase diagram using the bifurcation analysis.

**F-3(초)**

**Critical behavior of period doublings in coupled inverted pendulums**

Sang-Yoon Kim (Kangwon National University) and Bambi Hu (Hong Kong Baptist University) We study the critical behaviors of period doublings in  $N$  ( $N = 2, 3, 4, \dots$ ) coupled inverted pendulums by varying the driving amplitude  $A$  and the coupling strength  $c$ . It is found that the critical behaviors depend on

the range of coupling interaction. In the extreme long-range case of global coupling, in which each inverted pendulum is coupled to all the other ones with equal strength, the zero-coupling critical point and an infinity of critical line segments constitute the same critical set in the  $A - c$  plane, independently of  $N$ . However, for any other nonglobal-coupling cases of shorter-range couplings, the structure of the critical set becomes different from that for the global-coupling case, because of a significant change in the stability diagram of periodic orbits born via period doublings. The critical scaling behaviors on the critical set are also found to be the same as those for the abstract system of the coupled one-dimensional maps.

**F-4(초)**

**Lyapunov instability of rigid diatomic molecules via diatomic potential molecular dynamics** 금오연 (국방과학 연구소), 신영한, 이억균 (한국과학 기술원) We develop a molecular dynamic method with diatomic potential to evaluate the full Lyapunov spectrum for two-dimensional fluids composed of rigid diatomic molecules. The Lyapunov spectra are obtained for 18 rigid diatomic molecules for various bond lengths  $d$  ( $10^{-3} \leq d \leq 1.0$ ) in two-dimensions with periodic boundary conditions, and interacting with Hoover and Weeks-Chandler-Anderson short range repulsive forces. The general trends and characteristic features of the Lyapunov spectra are examined for both potentials. Our results are compared with those obtained from I. Borzák *et al.* [Phys. Rev. E **53**, 3694 (1966)], whose model uses the Lagrange multiplier method.

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**F-5(초)**

**Nonequilibrium roughening transition by q-state Potts particles** Byungnam Kahng and Sangsoo Park (Kon-Kuk University) We introduce an interface growth model exhibiting a nonequilibrium roughening transition (NRT) from a smooth phase



**F-P010****A Study on the Shear Rate Dependence of the Shear Viscosity** *K. H. Jung*

(*Chonbuk Univ.*) A molecular dynamics investigation of the microscopic behavior of a liquid subjected to shearing is carried out. The dynamical response of a liquid system and of a highly densified glassy system to various shear strain histories is outlined. At low shear rates, the data agree with the predictions of linear response theory. At higher shear rates, nonlinear behavior is observed. The shear rate dependence of the shear viscosity in the high shear regime seems to be best fitted by Ree-Eyring theory.

**F-P011****Appearance and Disappearance of Superfluid Vortices in a Narrow Annulus** *Chung-In Um and Ki-Ho Chang (Korea Univ.)*

The properties of the real vortices associated with their appearance or disappearance are obtained in a rotating annulus. Introducing the radial deviation of a ring of vortices from its equilibrium position, a new form of critical angular velocities symmetrically changed by the deviation is obtained for three types of experiments in a narrow annulus. It is shown that for the rotating inner cylinder, a ring of vortices with positive circulation cannot appear, while the ones with negative circulation are allowed to appear. Through a detailed calculation of the equilibrium position of a ring of stable vortices, it is shown that its ideal deviation has an uncertainty of about  $\pm 26\%$ , which gives the critical angular velocity about 7.3% larger than that without a deviation. For real systems, in which the vortices are unstable, it is shown that, for a constant angular velocity, the vortices have a permitted range of deviation from their equilibrium positions, beyond which they disappear. The characteristic deviation parameter, defined as the maximum permitted deviation, and the temperature dependent core radius provide a better description of the recent experimental results than the previous theories below about 1.8 K and very near  $T_\lambda$ , respectively. The experimental results below 1.8 K, almost uniformly larger

than the prediction of Swanson and Donnelly, are well explained by the deviation of vortices during their detection time.

**F-P012**

정전기를 이용한 거시입자의 2차원 상전이 연구 최용기, 김기범, 박혁규(부산대학교 물리학과) 이차원에서의 용융전이 과정은 삼차원에서와 달리 고체와 액체 사이에 중간과정인 hexatic 상태가 있다는 것이 KTHNY 이론에 의해 밝혀졌다. KTHNY 이론에 의하면 2차원 용융전이 과정에서는 unbinding-defect로 인해 2단계 상전이 과정이 나타난다. 본 실험에서는 이제까지의 micron 단위에서 실험해오던 것과 달리 세계 최초로 millimeter 단위의 거시입자를 사용하였고, 이 거시입자들을 마찰대전 과정을 이용해 coulomb입자로 만든 다음 현미경 같은 장비의 도움 없이 맨눈으로 2차원 상전이 과정을 연구하였다. 그리고 실험 결과들을 KTHNY의 2단계 상전이 이론과 비교하였다.

**F-P013****Photon correlation spectroscopy 방법을 이용한 polystyrene polymer의 온도 의존성 radius of gyration에 대한 연구** *Research Center for Dielectric & Advanced Matter Physics and The Department of Physics, Pusan National Univ.*

Dynamic light scattering (photon correlation spectroscopy) 방법을 이용하여 온도 변화에 따른 polystyrene polymer의 radius of gyration 변화를 연구하였다. 몇가지 다른 농도(0.05polymer 용액은 polystyrene powder를 good solvent인 toluene과 benzene에 용해시켜 준비하였으며, polymer의 radius of gyration은 Brookhaven BI-9000AT digital correlator를 이용하여 측정된 분산계수로부터 산출하였다. 실험으로부터 얻은 온도 의존성 polystyrene polymer의 radius of gyration을 이론과 비교 분석하였다.

**F-P014****Chaotic Behavior of a Damped Pendulum under Parametrical Driving** *E.A. Kim, M.Y. Choi, K.-C. Lee (Seoul National Univ.)*

We study the behavior of a damped pendulum, driven parametrically, and observe two successive transitions of dif-

