DOWNLOAD PDF CHAOS NEAR RESONANCE

Chapter 1 : CiteSeerX â€" Citation Query Geometry and chaos near resonant equilibria

The main emphasis is on near-integrable dissipative systems, but a separate chapter is devoted to resonance phenomena in Hamiltonian systems. A number of applications are described from the areas of fluid mechanics, rigid body dynamics, chemistry, atmospheric science, and nonlinear optics.

This implies that such systems possess periodic orbits with arbitrarily high period. The method uses techniques originally due to Melnikov and We give an example from structural mechanics: Robbins - Physica D , " Hamiltonian Lie-Poisson structures of the three-wave equations associated with the Lie algebras su 3 and su 2, 1 are derived and shown to be compatible. Poisson reduction is performed using the method of invariants and geometric phases associated with the reconstruction are calculated. These results can be applied to applications of nonlinear-waves in, for instance, nonlinear optics. Some of the general structures presented in the latter part of this paper are implicit in the literature; our purpose is to put the three-wave interaction in the modern setting of geometric mechanics and to explore some new things, such as explicit geometric phase formulas, as well as some old things, such as integrability, in this context. Show Context Citation Context They have also been used to analyze quasi-phase-matched second harmonic generation [26] in nonlinear optics where the transfer of energy or wave action among the waves is controlled by modulating t Homoclinic orbits near heteroclinic cycles with one equilibrium and one periodic orbit by Jens D. Rademacher - Journal of Differential Equations , " We analyze homoclinic orbits near codimensionâ€"1 and â€"2 heteroclinic cycles between an equilibrium and a periodic orbit for ordinary differential equations in three or higher dimensions. The main motivation for this study is a self-organized periodic replication process of travelling pulses which has The main motivation for this study is a self-organized periodic replication process of travelling pulses which has been observed in reaction diffusion equations. We establish conditions for existence and uniqueness of countably infinite families of curve segments of 1â€"homoclinic orbits which accumulate at codimensionâ€" 1 or â€"2 heteroclinic cycles. The main result shows the bifurcation of a number of curves of 1â€"homoclinic orbits from such codimensionâ€"2 heteroclinic cycles which depends on a winding number of the transverse set of heteroclinic points. In addition, a leading order expansion of the associated curves in parameter space is derived. Its coefficients are periodic with one frequency from the imaginary part of the leading stable Floquet exponents of the periodic orbit and one from the winding number. Numerically and analytically, heteroclinic cycles with periodic orbits have recently been found in several cases, cf. We point out analytic work concerning bifurcations for periodically forced systems in [41] and Hamiltonian systems near resonance in [14]. The splitting, not any bifurcation, of the codimensionâ€"2 he Parabolic resonances in 3 degree of freedom near-integrable Hamiltonian systems by Anna Litvak-hinenzon, Vered Rom-kedar, Communicated E. Ott - Physica D , " Perturbing an integrable 3 degree of freedom d. PRs of different types are either persistent or of low co-dimension, hence they appear robustly in many applicatio PRs of different types are either persistent or of low co-dimension, hence they appear robustly in many applications. Energyâ€"momenta bifurcation diagram is constructed as a tool for studying the global structure of 3 d. A link between the diagram shape, PR and the resonance structure is found. The differences between the dynamics appearing in 2 and 3 d. In previous works it has been shown that orbits which start in the vicinity of low dimensional resonant tori, exhibit under small perturbations intricate chaotic motion, see e. PR occurs in 2 d. Such a circle is persistent in a one parameter family of 2 d. Marsden - Physica D , " We derive and analyze several low dimensional Hamiltonian normal forms describing system symmetry breaking in ideal hydrodynamics. In many cases the result In many cases the resulting equations are completely integrable and have an interesting Hamiltonian structure. Our work is motivated by three-dimensional instabilities of rotating columnar fluid flows with circular streamlines such as the Burger vortex subjected to precession, elliptical distortion or off-center displacement. Marsden, Mary Silber - of Systems , " This paper uses Hamiltonian methods to find and determine the stability of some new solution branches for an equivariant Hopf bifurcation on C 4. The Hamiltonian part of the normal form is comple The Hamiltonian part of the normal form is completely integrable and may be analyzed using a system of invariants. The idea of the paper is to perturb relative equilibria in this singular Hamiltonian limit to obtain new three frequency solutions to the full normal form for parameter values near the Hamiltonian limit. The solutions obtained have fully broken symmetry, that is, they do not lie in fixed point subspaces. The methods developed in this paper allow one to determine the stability of this new branch of solutions. An example shows that the branch of three-tori can be stable. On Perturbed Oscillators in Resonance: Axially symmetric perturbations of the isotropic harmonic oscillator in three dimensions are studied. A normal form transformation introduces a second symmetry, after truncation. The reduction of the two symmetries leads to a one-degree-of-freedom system. We use a special set of action-angle variabl We use a special set of action-angle variables, as well as conveniently chosen generators of the ring of invariant functions. Both approaches are compared and their advantages and disadvantages are pointed out. The reduced flow of the normal form yields information on the original system. We illustrate the results by analysing the family of arbitrary axially symmetric cubic potentials. In case the integrable system is non-degenerate, the flow of this system makes the phase space a ramified torus bundle. For instance, in three degrees of Geometry and control of three-wave interactions by Mark S. Robbins - in The Arnoldfest , " The integrable structure of the three-wave equations is discussed in the setting of geometric mechanics. Lie-Poisson structures with quadratic Hamiltonian are associated with the three-wave equations through the Lie algebras su 3 and su 2, 1. A second structure having cubic Hamiltonian is shown to A second structure having cubic Hamiltonian is shown to be compatible. The analogy between this system and the rigid-body or Euler equations is discussed. We show that using piecewise continuous controls, the transfer of energy among three 1 waves can be controlled. The so called quasi-phase-matching control strategy, which is used in a host of nonlinear optical devices to convert laser light from one frequency to another, is described in this context. Finally, we discuss the connection between piecewise constant controls and billiards. On the linear level elliptic equilibria of Hamiltonian systems are mere superpositions of harmonic oscillators. Non-linear terms can produce instability, if the ratio of frequencies is rational and the Hamiltonian is indefinite. In particular we show that for the indefinite case 1: In contrast, we show that the frequency map itself is non-degenerate i. As a by product of our analysis of the fequency map we obtain another proof of fractional monodromy in the 1: Because the hypotheses can be easily verified by inspecting the vector field of the system, Because the hypotheses can be easily verified by inspecting the vector field of the system, this invariant manifold theory can be used to study the existence of invariant manifolds in systems involving a wide range of parameters and the persistence of invariant manifolds whose normal hyperbolicity vanishes when a small parameter goes to zero. We apply this invariant manifold theory to study three examples and in each case obtain results that are not attainable by classical normally hyperbolic invariant manifold theory. This continuation argument was then used as a general strategy for establishing the persistence of weakly normally hyperbolic invariant manifolds in several different model systems see, e. However, Chicone and Liu subsequently pointed out in [5] that this argument contains a conceptual gap because it fails to address the issue that the uniform boundedness of the generalized Lyapunov

Chapter 2 : CiteSeerX â€” Citation Query Chaos near resonance

The main mechanism of chaos near resonances is discussed in both the dissipative and the Hamiltonian context. Previously unpublished new results on universal homoclinic bifurcations near resonances, as well as on multi-pulse Silnikov manifolds are described.

Energy surfaces and hierarchies of bifurcations - instabilities in the forced truncated nls by Eli Shlizerman, Vered Rom-kedar " A two-degrees of freedom near integrable Hamiltonian which arises in the study of low-amplitude near-resonance envelope solutions of the forced Sine-Gordon equation is analyzed. The energy momentum bifurcation diagrams and the Fomenko graphs are constructed and reveal the bifurcation values at which The energy momentum bifurcation diagrams and the Fomenko graphs are constructed and reveal the bifurcation values at which the lower dimensional model exhibits instabilities and non-regular orbits of a new type. Furthermore, this study leads to some new insights regarding the hierarchy of bifurcations appearing in integrable Hamiltonian systems and the role of global bifurcations in the energy momentum bifurcation diagrams. Parabolic resonance, Near-integrable Hamiltonian systems, homoclinic chaos. Hamiltonian systems are a class of dynamical systems which can be characterised by preservation of a symplectic form. This allows to write down the equations of motion in terms of a single function, the Hamiltonian function. They were conceived in the 19th century to study physical systems varying f They were conceived in the 19th century to study physical systems varying from optics to frictionless mechanics in a unified way. This description turned out to be particularly efficient for symmetry reduction and perturbation analysis. Verhulst , " In this paper we study two degree of freedom Hamiltonian systems and applications to nonlinear wave equations. Near the origin, we assume that near the linearized system has purely imaginary eigenvalues: Using the averaging method, we compute the normal form and show that the dynamics differs from the usual one for Hamiltonian systems at higher order resonances. Under certain conditions, the normal form is degenerate which forces us to normalize to higher degree. The asymptotic character of the normal form and the corresponding invariant tori is validated using KAM theorem. This analysis is then applied to widely separated mode-interaction in a family of nonlinear wave equations containing various degeneracies. Both the local and global bifurcations of a parametrically and externally excited simply supported rectangular thin plate are analyzed. The method of multiple scales is used to find the averaged equatio The method of multiple scales is used to find the averaged equations. The numerical simulation of local bifurcation is given. The theory of normal form, based on the averaged equations, is used to obtain the explicit expressions of normal form associated with a double zero and a pair of purely imaginary eigenvalues from the Maple program. On the basis of the normal form, global bifurcation analysis of a parametrically and externally excited rectangular thin plate is given by the global perturbation method developed by Kovacic and Wiggins. The chaotic motion of the thin plate is found by numerical simulation. Tuwankotta, Ferdinand Verhulst , " This paper reviews higher order resonance in two degrees of freedom Hamiltonian systems. We consider a positive semi-definite Hamiltonian around the origin.

Chapter 3 : - Chaos Near Resonance (Applied Mathematical Sciences) by G. HALLER

Chaos Near Resonance is a well written and beautifuly illustrated book on resonances and dynamical systems theory. The book is authoritative and highly engaging to.

Chapter 4 : G. Haller (Author of Chaos Near Resonance)

The main mechanism of chaos near resonances is discussed in both the dissipative and the Hamiltonian context, incorporating previously unpublished new results on universal homoclinic bifurcations near resonances, as well as on multi-pulse Silnikov manifolds.

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Chapter 7 : Chaos Near Resonance : G. Haller :

Chaos Near Resonance Methods And Applications Chaos theory wikipedia, chaos theory is a branch of mathematics focusing on the behavior of dynamical systems that are highly sensitive to initial conditions 'chaos' is.

Chapter 8 : J.E. Marsden (Editor of Chaos Near Resonance)

The presence of resonance has often been related with the lack of smoothness of the linearization near the singularity, and therefore making the estimation of the Dulac map more complicated. However, it can lead to increasing the complexity of the dynamics, see for instance [5, 23] for more details.

Chapter 9 : ã€•Chaos Near Resonance (Applied Mathematical Sciences)ã€‘ ï»¿AW blog.quintoapp.com

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