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Evolution of rotations of a rigid body under the action of perturbing moment

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We investigate perturbed rotational motions of a rigid body, similar to regular precession in the Lagrange case, under the action of restoring and perturbing moments that are slowly changed in time. The restoring moment also depends on the angle of nutation. It is assumed that: the angular velocity of the body is large; restoring and perturbing moments are small with definite hierarchy of smallness of components. A small parameter is introduced in a special way. After performing the manipulations, we obtains a system of equations which contains two rotating phases and the corresponding frequencies are variable. The averaging method is used. We show that averaging of nonlinear system is equivalent to averaging of a quasi-linear system with constant frequencies. The averaged system of equations of motion is obtained in the first approximation for the essentially nonlinear two-frequency system in nonresonant and resonant cases. We consider the perturbed motion of a rigid body in the Lagrange case with allowance for the moments applied to the body from the external medium. We assume that the perturbing moments are linear-dissipative and slowly changed in time. We consider the problem of reduction of the top in state of regular precession by use of the small control moments. Thus, the new class of motions of axially symmetric body with regard to nonstationary restoring and perturbing moments is investigated. Problems of mechanics and control of rotations of a rigid body, meaning for applications are solved.

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Modeling noisy dynamical systems

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For a dynamical system one has often a model consisting of ordinary differential equations and on the other hand just a noisy time series of some observables of the system. In this contribution we treat the identification of parameters in the model from measured time series.

We apply a method known from the literature — the multiple shooting technique — for fitting of parameters for differential equations on clean as well as on noisy time series from numerical simulations and from experiment. For the simulated data from the Lorenz and the Rössler model we show that it is possible to fit the data to an universal three dimensional quadratic ansatz and to reconstruct here the true parameters of the original systems. We show also the improvement of the fit for data conterminated with dynamical noise (i. e. noise that interacts with the dynamics) by recontructing the deterministic part of the dynamics with a simple one-step prediction. Finally we apply the fitting algorithm to experimental data of an intracavity frequency doubled solid state laser.

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Quasi-static brittle fracture in inhomogeneous media and iterated conformal maps: Modes i, ii and iii

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We study the geometrical characteristic of quasi-static fractures of mode III in disordered brittle media. The evolution of the fracture pattern is achieved by using iterated conformal maps. This