MR2373767 37J35 (34C40)

Shamolin, M. V. (RS-MOSC)

A case of complete integrability in dynamics on a tangent bundle of a two-dimensional sphere. (Russian)

Uspekhi Mat. Nauk **62** (2007), *no. 5(377),* 169–170; *translation in Russian Math. Surveys* **62** (2007), *no. 5,* 1009–1011.

{A review for this item is in process.}

MR2342525 58A05 (57Rxx)

Aĭdagulov, R. R. (RS-MOSCM); **Shamolin, M. V.** (RS-MOSCM)

Manifolds of continuous structures. (Russian. Russian summary)

Sovrem. Mat. Fundam. Napravl. **23** (2007), 71–86.

{A review for this item is in process.}

MR2342524 74Bxx (35Q72)

Aĭdagulov, R. R. (RS-MOSCM); **Shamolin, M. V.** (RS-MOSCM)

A general spectral approach to the dynamics of a continuous medium. (Russian. Russian summary)

Sovrem. Mat. Fundam. Napravl. **23** (2007), 52–70.

{A review for this item is in process.}

MR2342523 (Review) 22A30

Aĭdagulov, R. R. (RS-MOSCM); **Shamolin, M. V.** (RS-MOSCM)

Archimedean uniform structures. (Russian. Russian summary)

Sovrem. Mat. Fundam. Napravl. **23** (2007), 46–51.

Summary (translated from the Russian): "In mathematics, the concept of the Archimedean property is used in connection with two different objects: orderings of groups and valuations of rings. In both cases, one can define a topology on these objects and even a uniform structure; in the first case, an interval topology, and in the second, a certain valuation. It turns out that these two uses of the term Archimedean property and the somewhat regrettable term 'topological group without small subgroups' are special cases of the concept of the Archimedean property of a topological group."

MR2342521 01A70

Georgievskiĭ, D. V.; **Shamolin, M. V.**

Valeriĭ Vladimirovich Trofimov. (Russian)

Sovrem. Mat. Fundam. Napravl. **23** (2007), 5–15.

{There will be no review of this item.}

MR2252203 (2007c:70009) 70E15 (70E40 70E45 70H06)

Shamolin, M. V.

Comparison of Jacobi-integrable cases of two- and three-dimensional motions of a body in a medium in the case of a jet flow. (Russian. Russian summary)

Prikl. Mat. Mekh. **69** (2005), *no. 6,* 1003–1010; *translation in J. Appl. Math. Mech.* **69** (2005), *no. 6,* 900–906 (2006).

Summary (translated from the Russian): "We show the complete integrability of the plane problem of the motion of a rigid body in a resisting medium under jet flow conditions, when one first integral, which is a transcendental function of quasi-velocities (in the sense of the theory of functions of a complex variable with essentially singular points), exists in the system of equations of motion. It is assumed that the entire interaction of the medium with the body is concentrated on a part of the surface of the body that has the shape of a (one-dimensional) plate. We generalize this plane problem to the three-dimensional case, where a complete set of first integrals exists for the equations of motion: one analytic, one meromorphic, and one transcendental. Here we assume that the entire interaction of the medium with the body is concentrated on part of the surface of the body that has the shape of a flat (two-dimensional) disk. We also attempt to construct a generalization of the 'low-dimensional' cases to the dynamics of a so-called four-dimensional rigid body whose interaction with a medium is concentrated on a part of the (three-dimensional) surface of the body that has the shape of a (three-dimensional) sphere. In this case, the angular velocity vector is six-dimensional, while the velocity of the center of mass is four-dimensional."

MR2225204 (2007a:70009) 70E40 (37J35 70H06)

Shamolin, M. V. (RS-MOSC)

On an integrable case of equations of dynamics on $\mathrm{so}(4) \times \mathbb{R}^4$. (Russian)

Uspekhi Mat. Nauk **60** (2005), *no. 6(366),* 233–234; *translation in Russian Math. Surveys* **60** (2005), *no. 6,* 1245–1246.

The four-dimensional analog of the problem on the motion of a rigid body under the action of resistance forces with variable dissipation and of a servo-constraint is studied. The rotational part of the equations of motion is considered under the assumption that the body is dynamically symmetric. It is shown that under appropriate conditions the equations of motion possess an invariant surface. For the motions restricted to this surface transcendental first integrals are indicated.

Reviewed by *Alexander Burov*

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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

MR2216035 (2006m:70012) 70E40
Shamolin, M. V. (RS-MOSC-IMC)

A case of complete integrability in the three-dimensional dynamics of a rigid body interacting with a medium taking into account the rotational derivatives of the momentum of forces of angular velocity. (Russian)

Dokl. Akad. Nauk **403** (2005), *no. 4,* 482–485; *translation in Dokl. Phys.* **50** (2005), *no. 8,* 414–418.

From the text (translated from the Russian): "Because of its complexity, the problem of the motion of a rigid body in an unbounded medium requires the introduction of simplifying restrictions. The main goal is to introduce hypotheses that allow one to study the motion of a rigid body separately from the motion of the medium in which the body is located. On the one hand, a similar approach was taken in the classical Kirchhoff problem of the motion of a body in an unbounded ideal incompressible fluid which is at rest at infinity and which undergoes irrotational motion. On the other hand, it is clear that the aforementioned Kirchhoff problem does not exhaust the possibilities of this type of modeling.

"In this paper, we consider the possibility of transferring the results of the dynamics of the plane-parallel motion of a homogeneous axisymmetric rigid body interacting at its front circular face with a uniform flow of a resisting medium to the case of three-dimensional motion. Here, unlike in previous papers on the modeling of the interaction between a medium and a rigid body, we take into account the effects of the so-called rotational derivatives of the moment of hydroaerodynamic forces with respect to the components of the angular velocity of the rigid body itself.”

MR2171058 (2006d:11150) 11Y16

Aĭdagulov, R. R.; **Shamolin, M. V.**

A refinement of Conway’s algorithm. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **2005,** *no. 3,* 53–55, 71; *translation in Moscow Univ. Math. Bull.* **60** (2005), *no. 3,* 34–35 (2006).

Summary (translated from the Russian): “We refine Conway’s algorithm for computing prime numbers. In the course of analyzing it, we establish that some numbers obtained using it are erroneous. Further investigation leads to the determination of tabularly computable functions and the establishment of the equivalence of this class of functions and the class of recursive functions.”

MR2131714 (2005m:70050) 70E99 (70K99)

Shamolin, M. V. (RS-MOSC-MC)

Geometric representation of motion in a problem of the interaction of a body with a medium. (Russian. English, Ukrainian summaries)

Prikl. Mekh. **40** (2004), *no. 4,* 137–144; *translation in Internat. Appl. Mech.* **40** (2004), *no. 4,* 480–486.

From the text (translated from the Russian): “We carry out a complete qualitative analysis of a model version of the plane-parallel motion of a body in a resisting medium under a jet-flow condition for the oscillatory domain of the phase space of the dynamic equations. We assume that the velocity of the center of the plate through which the body interacts with the medium remains constant throughout the motion. As was shown earlier, the dynamical system in the space of quasivelocities is relatively structurally stable (robust with respect to physically admissible classes of dynamical systems). We consider an additional qualitative integration of the kinematic relations. We study the properties of the solutions corresponding to the oscillatory domain: the properties of the asymptotes associated with the motion of the rigid body, various equivalence relations in the trajectory space, topological analogies, and mechanical interpretations of asymptotic motions. We study the local property of the asymptote."

MR2082898 (2005j:70014) 70E99 (34C40 37N05 70K05)

Shamolin, M. V.

Classes of variable dissipation systems with nonzero mean in the dynamics of a rigid body. Dynamical systems.

J. Math. Sci. (N. Y.) **122** (2004), *no. 1,* 2841–2915.

In this paper the author applies a rather simplified mechanical model for the study and explanation of nontrivial effects arising in the plane-parallel and spatial motions of a rigid body in a resisting medium. He assumes that the interaction of the medium with the body is concentrated at the front part of the body's surface, which has the form of a flat plate.

The paper consists of six chapters. In the first chapter the author considers several forms of nonlinear dynamical systems describing the motion of a body in a medium. In the next four chapters the author develops the standard methods of the qualitative theory of ordinary differential equations and successfully uses them for investigation and classification of phase trajectories of dissipative systems of special types. In the final chapter he studies the stability of the translational deceleration and self-oscillations of the moving body in the presence of a linear damping momentum.

Reviewed by *A. Ya. Savchenko*

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Georgievskiĭ, D. V.; **Shamolin, M. V.**

First integrals of the equations of motion of a generalized gyroscope in $\mathbf{R}^n$.
(Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **2003,** *no. 5,* 37–41, 72–73; *translation in Moscow Univ. Math. Bull.* **58** (2003), *no. 5,* 25–29 (2004).

Summary (translated from the Russian): "By analogy with a three-dimensional space, a generalized gyroscope in $\mathbf{R}^n$ is a rigid body with a fixed point in which all the moments of inertia with respect to n hyperplanes are divided into two groups, and in each group the moments are equal to each other. In this case, the well-known system of $n(n-1)/2$ generalized Euler dynamic equations has a specified number of first integrals, which depends on the inertia structure of the gyroscope, and reduces to a linear nonhomogeneous nonautonomous system. We study in detail the case $n = 4$."

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Shamolin, M. V.

Foundations of differential and topological diagnostics.

Dynamical systems, 12.

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The paper presents the results of an analysis of the aircraft control system diagnostics problem. The motion of the control system is described by nonlinear ordinary differential equations. First the diagnostics problem is considered in the case of exact trajectorial measurements. Second, trajectorial measurements corrupted by normal white noise with zero mean value and bounded spectrum are analyzed. Third, trajectorial measurements are investigated in the case when their errors are normal random variables whose absolute values are bounded by a certain function of time. Solving the diagnostics problem allows one to repair the control system and isolate the trouble. To solve the diagnostics problem the following data are used: the mathematical model of the motion of the object, the bounded domain of its initial conditions and the list of models describing the motion of this object with a fault. A statistical-modelling method for selection of the checking surface selection is proposed and checking surface accessibility conditions are investigated. A description of diagnostic techniques involving selection of the checking surface is proposed. Particular attention is given to the case of linear systems. The author emphasizes the deep differences of his approach to the diagnostics problem in comparison with other works. Namely, the diagnostics problem is considered in terms of a classification of malfunctions. The mathematical modelling of malfunctions is presented in this context. General statements of the differential diagnostics problem are discussed in detail. Various extensions of the diagnostics theorem are described.

Reviewed by Valery I. Korobov (Khar′kov)

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New integrable cases and families of portraits in the plane and spatial dynamics of a rigid body interacting with a medium.

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Several models are considered for the motion of a rigid body in a resisting medium (like a gas or a fluid). Probably the best known model in this area is the Kirchhoff system for the motion of a rigid body in an ideal fluid. In the present paper somewhat different physical assumptions are used. The resulting differential equations are nonlinear systems of dimension 2, 3, or 4. Their phase portraits are analysed, and several integrable cases are pointed out.

Reviewed by *Yuri B. Suris*

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MR1930111 (2003g:70008) 70E17
Georgievskiĭ, D. V. (RS-MOSC); **Shamolin, M. V.** (RS-MOSC)
Generalized dynamic Euler equations for a rigid body with a fixed point in $\mathbb{R}^n$. (Russian)
Dokl. Akad. Nauk **383** (2002), *no. 5,* 635–637; *translation in Dokl. Phys.* **47** (2002), *no. 4,* 316–318.

The authors continue the investigations they began in an earlier paper [Dokl. Akad. Nauk **380** (2001), no. 1, 47–50; MR1867984 (2003a:70002)] in which they studied the kinematics and mass geometry of an n-dimensional rigid body with a fixed point in $\mathbf{R}^n$. The present paper contains a derivation of the generalized dynamic Euler equations for this problem. Using the representation of a differential equation that generalizes the classical law of the change in angular momentum of a body in terms of dual tensors, the authors obtain generalized dynamic Euler equations. They consider in detail the case when there are no external forces. For this case they show that the number of independent first integrals is less than the number of components of angular velocity by the value $\frac{1}{2}(n-2)(n-1)$.

Reviewed by *Gennady Victorovich Gorr*

MR1919087 (2004j:37161) 37N05 (34C05 37G15 70E15 70K50)
Shamolin, M. V.
Some questions of the qualitative theory of ordinary differential equations and dynamics of a rigid body interacting with a medium.
Dynamical systems, 10.
J. Math. Sci. (New York) **110** (2002), *no. 2,* 2528–2557.

This paper is a translated version of the Russian original; it contains several mistakes and typos. The paper treats the problem of appearance (or disappearance) of limit cycles for a vector field on $\mathbb{R}^2$. A survey is offered and old results such as the Hopf bifurcation scenario are recalled. The author shows how such bifurcations occur in a system describing the motion of a rigid body interacting with a medium. Stokes' theorem (refered to as the Gauss-Ostrogradskiĭ formula or the Green formula in the present paper), as well as the Poincaré-Bendixson theorem, are used repeatedly.

Reviewed by *Vincent Naudot*

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Mekh., **113**, No. 2, 66–70 (1993). MR1223987 (94b:34060)
37. M. V. Shamolin, "A new two-parameter family of phase portraits in the problem of the motion of a body in a medium," *Phys. Dokl.*, **39**, No. 8, 587–590 (1994). MR1298329 (95g:70006)
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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

MR1914556 (2003g:34019) 34A34 (34A05 34C40 70E40)
Shamolin, M. V. (RS-MOSC)
On the integration of some classes of nonconservative systems. (Russian)
Uspekhi Mat. Nauk **57** (2002), *no. 1(342),* 169–171; *translation in Russian Math. Surveys* **57** (2002), *no. 1,* 161–162.

Some systems of a nonconservative type encountered in the dynamics of rigid bodies interacting with a medium are considered.

Proposition. The $(2n-1)$-parametric set of systems of equations on the plane $\mathbf{R}^2(x,y)$,

$$\dot{x} = ax + by + \sum_{i=1}^{2n-1} \delta_i x^{2n-i} y^{i-1},$$

$$\dot{y} = cx + dy + \sum_{i=1}^{2n-1} \delta_i x^{2n-(i+1)} y^{i},$$

has a (generally speaking, transcendental) first integral, expressed via elementary functions.

Reviewed by *L. M. Berkovich*

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5. M. V. Shamolin, *Dokl. Akad. Nauk* **364** (1999), 627–629; English transl., *Dokl. Phys.* **44** (1999), 110–113. MR1702618 (2000k:70008)

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

MR1868040 (2002f:70005) 70E40 (70H06)
Shamolin, M. V.
Complete integrability of equations of motion of a spatial pendulum in an incident medium flow. (Russian. Russian summary)
Vestnik Moskov. Univ. Ser. I Mat. Mekh. **2001,** *no. 5,* 22–28, 70.

Summary (translated from the Russian): “Previously, we considered the problem of a plane pendulum in an incident medium flow. In the present paper we construct a generalization of this problem to the spatial case. We establish the complete integrability in the sense of Jacobi of this problem. In the plane case there sometimes exists a single transcendental first integral expressed in terms of elementary functions, but in the spatial case there can be several such integrals (under certain conditions).”

MR1867984 (2003a:70002) 70B10 (70E17)
Georgievskiĭ, D. V. (RS-MOSC); **Shamolin, M. V.** (RS-MOSC)
Kinematics and mass geometry of a rigid body with a fixed point in $\mathbb{R}^n$. (Russian)
Dokl. Akad. Nauk **380** (2001), *no. 1,* 47–50; *translation in* *Dokl. Phys.* **46** (2001), *no. 9,* 663–666.

The authors consider the kinematics and mass geometry of a rigid body with a fixed point in an n-dimensional space. Using the generalized Euler formula and the angular velocity tensor they determine the velocities of the points of the body. The angular velocity tensor of $(n-2)$nd rank is associated with the dual angular velocity tensor of the second rank. The authors use the generalized

Rival formula to determine the accelerations of the points of the body. In the case of hyperplane motion, they determine the components of the angular velocity tensor and the components of the dual angular velocity. They find relations for the angular momentum of the body for kinetic energy. They show that the mass geometry of an n-dimensional rigid body is determined by the second-order symmetric inertia tensor. For $n = 3$, the tensor $\mathbf{I}^{(2)}$, introduced to define the angular momentum, and the tensor $\mathbf{J}^{(2)}$, characterizing the kinetic energy, coincide and are the conventional inertia tensor in $\mathbf{R}^3$. The results obtained are only of theoretical interest.

Reviewed by *Gennady Victorovich Gorr*

MR1872149 (2002i:70006) 70E40

Shamolin, M. V. (RS-MOSC-MC)

Integrability cases for equations of the three-dimensional dynamics of a rigid body. (Russian. English, Ukrainian summaries)

Prikl. Mekh. **37** (2001), *no. 6,* 74–82; *translation in Internat. Appl. Mech.* **37** (2001), *no. 6,* 769–777.

Summary: "A dynamic model of the interaction of a rigid body with a resisting medium under conditions of a jet flow is considered. This model allows one to extend the results for the corresponding problems from plane dynamics of a rigid body interacting with the medium and to obtain their three-dimensional analogues, as well as to establish the integrability in the sense of Jacobi of the new cases. Thus, the integrals in some cases can be expressed in terms of elementary functions. The classical problem of a spherical pendulum in a jet flow and that of the motion of a three-dimensional body with a servoconstraint are proved to be integrable. Mechanical and topological analogues of these problems are presented."

MR1844242 (2002d:90024) 90B25

Borisenok, I. T.; **Shamolin, M. V.**

Solution of the differential diagnostic problem by the statistical testing method. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **2001,** *no. 1,* 29–31, 72.

Summary (translated from the Russian): "The differential diagnostic problem for the functional state of control plants having a modular structure and a finite set of possible failures can be reduced to two independent sequentially solvable problems: the control problem, i.e., the establishment of a criterion for the presence of failure in the system, and the diagnostic problem, i.e., the identification of the failure. The criterion for failure in the system can be the plant trajectory leaving some prespecified surface. The failure can occur at any previously unknown instant during the motion of the plant and at any point within the specified surface. The diagnostic problem can be solved by tracking the trajectory of the plant after its departure from the control surface. We give a solution to the differential diagnostic problem for dynamical control systems in the case of trajectory measurements with noise, starting from general probabilistic considerations."

MR1833828 (2002c:70005) 70E15

Shamolin, M. V. (RS-MOSC-IMC)

Integrability in the sense of Jacobi in the problem of the motion of a four-dimensional rigid body in a resisting medium. (Russian)

Dokl. Akad. Nauk **375** (2000), *no. 3,* 343–346; *translation in Dokl. Phys.* **45** (2000), *no. 11,* 632–634.

From the text (reviewer's translation): "This paper is devoted to studying the motion of a so-called four-dimensional rigid body that interacts with a resisting medium according to 'streamline flows'. It is assumed that all the interactions of the rigid body with the medium are concentrated on the part of the surface of the body (three-dimensional) that has the shape of a ball (three-dimensional)."

The results are as in the title.

Reviewed by *J. S. Joel*

MR1777365 (2002d:34049) 34C05
Shamolin, M. V. (RS-MOSC)
On limit sets of differential equations near singular equilibrium points. (Russian)
Uspekhi Mat. Nauk **55** (2000), *no. 3(333),* 187–188; *translation in Russian Math. Surveys* **55** (2000), *no. 3,* 595–596.

For the third-order system

$$\alpha' = -z_2 + \sigma(z_1^2 + z_2^2)\sin\alpha + \sigma n_0^2 \sin\alpha\cos^2\alpha + (B\sin\alpha\cos\alpha)/m,$$
$$z_2' = n_0^2 \sin\alpha\cos\alpha - z_2\psi(\alpha, z_1, z_2) - z_1^2\cos\alpha/\sin\alpha,$$
$$z_1' = -z_1\psi(\alpha, z_1, z_2) + z_1 z_2 \cos\alpha/\sin\alpha,$$

where

$$\psi(\alpha, z_1, z_2) = -\sigma(z_1^2 + z_2^2)\cos\alpha + \sigma n_0^2 \sin^2\alpha\cos\alpha - (B\cos^2\alpha)/m,$$

$\sigma, n_0, B, m > 0$, the author proves the existence of an attracting limit cycle in the spherical layer $\Pi_{(0,\pi)} = \{(\alpha, z_1, z_2) \in \mathbb{R}^3\colon\ z_1 > 0,\ 0 < \alpha < \pi\}$.

Reviewed by *A. P. Sadovskiĭ*

References

1. H. Poincaré, *On curves defined by differential equations*, OGIZ, Moscow-Leningrad 1947 (Russian); French original in *Œuvres de Henri Poincaré*, vol. 1, Guathier-Villars, Paris 1928.
2. A. A. Andronov, *Collected works*, Izdat. Akad. Nauk SSSR, Moscow 1956. (Russian) MR0156047 (27 #5980)
3. A. A. Andronov and E. A. Leontovich, ”Some cases of the dependency of limit cycles on a parameter”, *Uchen. Zap. Gorkov. Gos. Univ.* **1937**, no. 6. (Russian)
4. E. Hopf, ”Abzweigung einer periodischen Lösung von einer stationären Lösung eines Differentialsystems”, *Ber. Verh. Sächs. Akad. Wiss. Leipzig Math.-Nat. Kl.* **95** (1943), 3–22. MR0039141 (12,501c)
5. M. V. Shamolin, *Uspekhi Mat. Nauk* **52**:3 (1997), 177–178; English transl., *Russian Math. Surveys* **52** (1997), 621–622. MR1479402 (99a:34089)
6. M. V. Shamolin, *Dokl. Akad. Nauk* **337** (1994), 611–614; English transl., *Phys. Dokl.* **39** (1994), 587–590. MR1298329 (95g:70006)
7. M. V. Shamolin, *Dokl. Akad. Nauk* **349** (1996), 193–197; English transl., *Phys. Dokl.* **41** (1996), 320–324. MR1440994 (98b:70009)

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

MR1776307 (2001k:70006) 70E15 (34C60 37C75 74F10)
Shamolin, M. V. (RS-MOSC-MC)

A new family of phase portraits in the three-dimensional dynamics of a rigid body interacting with a medium. (Russian)

Dokl. Akad. Nauk **371** (2000), *no. 4,* 480–483; *translation in* *Dokl. Phys.* **45** (2000), *no. 4,* 171–174.

The three-dimensional dynamics of a rigid body interacting with a viscous medium has been given an acceptable qualitative description in only the very simplest, most simplified situations. The dynamical model used in the present paper is rather simple and enables the author to form the equations of motion of the body without preliminary computations of detailed characteristics of the motion of the medium (for more details see the book by B. Ya. Lokshin, V. A. Privalov, and V. A. Samsonov [Введение в задачу о движении тела в сопротивляющейся среде (*Introduction to the problem of the motion of a body in a resisting medium*), Izdat. Mosk. Gos. Univ., Moscow, 1986; per bibl.]). In this paper the author attempts to generalize to the three-dimensional case a number of his results obtained for the plane-parallel dynamics of a body in a resisting medium. The correctness of such a generalization was discussed previously by the author [Izv. Ross. Akad. Nauk Mekh. Tverd. Tela **1997**, no. 2, 65–68; RZhMat 1997:11 B291].

Thus, the author studies the fast motion of a dynamically symmetric body undergoing conditions of stream flow. The interaction of the medium with the body is concentrated at the bow (front part) of the surface of the body, which has the form of a flat disk. The author writes down the equations of motion of the body, and by excluding the cyclic variables he distinguishes an independent subsystem of three autonomous equations. Then he studies the singular points of the vector field on a three-dimensional noncompact (open) manifold. The analysis of the limit sets and the separatrices allows him to describe qualitatively the phase topology of the reduced system. Then the author introduces an index that characterizes the behavior of the separatrices of the trajectories, and using this index he classifies a countable number of topologically distinct phase portraits that occur in the given problem.

Reviewed by *Igor Gashenenko*

MR1806854 90B25
Borisenok, I. T.; **Shamolin, M. V.** (RS-MOSC)
Solution of a problem of differential diagnostics. (Russian. English, Russian summaries)
New computer technologies in control systems (Russian) (Pereslavl′-Zalesskiĭ, 1996).
Fundam. Prikl. Mat. **5** (1999), *no. 3,* 775–790.

{This item will not be reviewed individually. For details of the collection in which this item appears see MR1806845 (2001g:49003) .}
{For the entire collection see MR1806845 (2001g:49003)}

MR1741681 (2000j:37021) 37C20 (34D30 70E99 70K99)
Shamolin, M. V. (RS-MOSC)
Robustness of dissipative systems and relative robustness and nonrobustness of systems with variable dissipation. (Russian)
Uspekhi Mat. Nauk **54** (1999), *no. 5(329),* 181–182; *translation in* *Russian Math. Surveys* **54** (1999), *no. 5,* 1042–1043.

From the text (translated from the Russian): "We present a brief survey of problems of relative structural stability (relative robustness) of dynamical systems considered not on the entire space of dynamical systems but only on some subspace of it [M. V. Shamolin, Uspekhi Mat. Nauk **51** (1996), no. 1(307), 175–176; MR1392692 (97f:70010)]."

MR1702618 (2000k:70008) 70E40 (70H06)
Shamolin, M. V. (RS-MOSC-MC)
New integrable, in the sense of Jacobi, cases in the dynamics of a rigid body interacting with a medium. (Russian)
Dokl. Akad. Nauk **364** (1999), *no. 5,* 627–629; *translation in* *Dokl. Phys.* **44** (1999), *no. 2,* 110–113.

From the text (translated from the Russian): "The dynamic model of the interaction of a rigid body with a resisting medium under jet flow conditions that is considered not only allows us to successfully transfer the results of corresponding problems from the two-dimensional dynamics of a rigid body interacting with a medium and to obtain their three-dimensional analogues, it also reveals new Jacobi-integrable cases. Here the integrals can sometimes be expressed in terms of elementary functions. We demonstrate the integrability of the classical problem of a spherical pendulum submerged in an incident flow of a medium and the problem of the three-dimensional motion of a body in the presence of a servoconstraint. We also give mechanical and topological analogues of the latter two problems."

MR1657632 (99h:34006) 34A20 (30D30)
Shamolin, M. V. (RS-MOSC)
On integrability in transcendental functions. (Russian)
Uspekhi Mat. Nauk **53** (1998), *no. 3(321),* 209–210; *translation in* *Russian Math. Surveys* **53** (1998), *no. 3,* 637–638.

The problem of integrability of systems of ordinary differential equations in transcendental functions is discussed in this paper.

Reviewed by *Shamil Makhmutov*

MR1479402 (99a:34089) 34C05 (34C11)
Shamolin, M. V. (RS-MOSC)
Spatial Poincaré topographical systems and comparison systems. (Russian)
Uspekhi Mat. Nauk **52** (1997), *no. 3(315),* 177–178; *translation in* *Russian Math. Surveys* **52** (1997), *no. 3,* 621–622.

The notions of the Poincaré topographical system, the characteristic function and the comparison system are generalised for the higher-dimensional case. Theorem. Assume that in the 1-connected domain $D \subset \mathbf{R}^n$ containing a unique singular point x_0 of the smooth vector field v, there exists the hypersurface $\Gamma \ni x_0$, $\Gamma \cap \partial D = \gamma$ such that there exists a Poincaré topographical system, having a center at x_0 and defined by a smooth function V, extended along Γ up to γ, filling the domain $K \subseteq D$ and such that $(v, \mathrm{grad}\, V)|_{\mathbf{R}^n} \geq 0$ in K. Then in the domain D there is no closed curve consisting of the trajectories of the vector field v and intersecting Γ. Applications to the center-focus problem are discussed.

Reviewed by *Natalia Borisovna Medvedeva*

MR1644665 (99e:70027) 70E99 (34C99)
Shamolin, M. V.
An introduction to the problem of the braking of a body in a resisting medium, and a new two-parameter family of phase portraits. (Russian. Russian summary)
Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1996,** *no. 4,* 57–69, 112.

Summary (translated from the Russian): “We actually begin with a consideration of a model version of the problem of free plane-parallel braking of a rigid body in a resisting medium under conditions of jet-type or detached flow. We carry out a qualitative analysis of the systems of differential equations that describe a given class of motions and, based on it, obtain a new two-parameter family of phase portraits consisting of an uncountable set of nonequivalent portraits without limit cycles.”

MR1440994 (98b:70009) 70E15 (34C05 70K05 76B10)
Shamolin, M. V. (RS-MOSC)
Manifold of phase portrait types in the dynamics of a rigid body interacting with a resisting medium. (Russian)
Dokl. Akad. Nauk **349** (1996), *no. 2,* 193–197; *translation in Phys. Dokl.* **41** (1996), *no. 7,* 320–324.

The author considers a version of the plane-parallel motion of a rigid body in a resisting medium. He assumes that a part of the body’s surface has the shape of a flat plate and that the interaction of the medium with the body is concentrated at precisely this part. A similar model proves useful in the investigation of bodies moving in a jet flow.

By eliminating the cyclic coordinates, the equations of motion are reduced to a second-order autonomous system. The author uses qualitative methods to study and classify the phase trajectories of the reduced dynamical system. In particular, he studies limit cycles and singular points of the vector field, and the behavior of stable and unstable separatrices. The presence of free parameters adds additional complexity to the system. For example, the author presents a two-parameter family of dynamical systems with a countable set of topologically different phase portraits.

Reviewed by *Igor Gashenenko*

MR1392692 (97f:70010) 70E15

Shamolin, M. V. (RS-MOSC)

Determination of relative robustness and a two-parameter family of phase portraits in the dynamics of a rigid body. (Russian)

Uspekhi Mat. Nauk **51** (1996), *no. 1(307),* 175–176; *translation in Russian Math. Surveys* **51** (1996), *no. 1,* 165–166.

The author gives a definition of the relative robustness of a system of differential equations that differs from previously used definitions. It contains two main points: sufficient smallness of the homeomorphism that produces the equivalence, and C^1-topology in the space of vector fields. As an example, the author considers a problem that describes the dynamics of a rigid body interacting with a medium. He proves a theorem on absolute robustness, from which it follows that there exists a two-parameter family of phase portraits in which a degenerate transition occurs in the passage from one topological portrait type to another. It should be noted that the space in which the system is absolutely robust has finite measure, while the space in which the system is a system of the first degree of robustness has measure zero in the original space.

Reviewed by *Gennady Victorovich Gorr*

MR1809236 70K99 (34D30 37C20 37N05)

Shamolin, M. V.

Relative structural stability of dynamical systems in the problem of the motion of a body in a medium. (Russian)

Analytic, numerical and experimental methods in mechanics (*Russian*), 14–19, *Moskov. Gos. Univ., Moscow*, 1995.

{This item will not be reviewed individually. For details of the collection in which this item appears see MR1809235 (2001g:00013) .}

{For the entire collection see MR1809235 (2001g:00013)}

MR1298329 (95g:70006) 70E15 (34C99 70K05)

Shamolin, M. V. (RS-MOSC)

A new two-parameter family of phase portraits in the problem of the motion of a body in a medium. (Russian)

Dokl. Akad. Nauk **337** (1994), *no. 5,* 611–614; *translation in Phys. Dokl.* **39** (1994), *no. 8,* 587–590.

The paper deals with the Kirchhoff problem on the motion of a rigid body in an infinite ideal incompressible fluid medium. The author considers a sixth order dynamic system from which a second order subsystem splits off. The complete topological classification of phase portraits is carried out and a two-parameter family of phase portraits consisting of an uncountable set of topologically distinct phase portraits is isolated.

Reviewed by *V. A. Sobolev*

MR1293942 (95e:34036) 34C35 (34C99)

Shamolin, M. V.

Existence and uniqueness of trajectories that have points at infinity as limit sets for dynamical systems on the plane. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1993,** *no. 1,* 68–71, 112.

Summary (translated from the Russian): “We consider dynamical systems on the plane, cylinder and sphere. For some classes of systems we prove the existence and uniqueness of trajectories going out to infinity in the plane. For one-parameter systems of equations having monotonicity properties on two-dimensional oriented surfaces, we examine the problem of the existence and uniqueness of limit sets and their monotone dependence on the parameters.”

MR1258007 (94i:70027) 70K99 (34C99 70K20 76B05)

Shamolin, M. V.

Phase portrait classification in a problem on the motion of a body in a resisting medium in the presence of a linear damping moment. (Russian. Russian summary)

Prikl. Mat. Mekh. **57** (1993), *no. 4,* 40–49; *translation in J. Appl. Math. Mech.* **57** (1993), *no. 4,* 623–632.

Summary (translated from the Russian): “We present a qualitative analysis of a dynamical system that describes a model version of the problem of the plane-parallel motion of a body in a medium with jet or separated flow when the entire interaction of the medium with the body is concentrated on a part of the surface of the body having the form of a flat plate. The force of the interaction is directed along the normal to the plate, and the point of application of this force depends only on the angle of attack. A thrust force acts along the mean perpendicular to the plate, which ensures that the value of the velocity of the center of the plate remains constant throughout the motion. In addition, a damping moment, linear with respect to the angular velocity, is imposed on the body. We carry out the phase portrait classification of the system depending on the coefficient of the moment. We note the mechanical and topological analogies with a pendulum fixed in a flowing medium.”

MR1223987 (94b:34060) 34C99 (34C05 34C25 76D99)

Shamolin, M. V.

Application of the methods of Poincaré topographical systems and comparison systems in some concrete systems of differential equations. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1993,** *no. 2,* 66–70, 113.

Summary (translated from the Russian): "We consider autonomous systems on the plane or a two-dimensional cylinder and study questions of the existence for various classes of systems of Poincaré topographical systems or more general comparative systems. As applications we consider dynamical systems that describe the plane-parallel motion of a body in a resisting medium as well as various model variants of it."

MR1293705 (95d:34060) 34C23 (34C05 34C25 70E15)

Shamolin, M. V.

Closed trajectories of various topological types in the problem of the motion of a body in a resisting medium. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1992,** *no. 2,* 52–56, 112.

Summary (translated from the Russian): "We consider dynamical systems on a two-dimensional cylinder. We sharpen the theorems of Hopf, Bendixson and Dulac, after which it becomes possible to study closed trajectories of various topological types in connection with the problem of the motion of a body in a resisting medium. We give an example of a class of systems in the phase space of which there exists a continuum of closed trajectories of different types."

MR1214592 (93k:70028) 70H05 (34C05 34C25 58F40 70E15)

Shamolin, M. V.

On the problem of the motion of a body in a resistant medium. (Russian. Russian summary)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1992,** *no. 1,* 52–58, 112.

Summary (translated from the Russian): "We continue a qualitative analysis of a model variant of the interaction of a body with a resistant medium. Under the assumption that the motion is plane-parallel we completely analyze the case of constant velocity of the center of mass. We prove the presence of nonisolated periodic solutions, the absence of limit cycles and transcendental integrability, and present necessary and sufficient conditions for expressing the integral in terms of elementary functions."

MR1029730 (90k:70007) 70E99 (58F40 76D25)

Samsonov, V. A.; **Shamolin, M. V.**

On the problem of the motion of a body in a resisting medium. (Russian)

Vestnik Moskov. Univ. Ser. I Mat. Mekh. **1989,** *no. 3,* 51–54, 105.

Summary (translated from the Russian): "We consider a variant of the problem on the motion of a body in a resisting medium under the assumption that the interaction of the medium with the body is confined to a part of the surface of the body, which has the form of a flat plate. For plane-parallel motion we completely analyze the case of constant velocity of the center of the plate. We prove the nonexistence of auto-oscillations and prove transcendental integrability."